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Form SF298 Citation Data

Report Date <i>("DD MON YYYY")</i> 00062000	Report Type N/A	Dates Covered (from... to) <i>("DD MON YYYY")</i>
Title and Subtitle Combining Sequential and Cumulative Air Strategies for Victory: The Past Informs the Future		Contract or Grant Number
		Program Element Number
Authors Ducharme, Courtney A.		Project Number
		Task Number
		Work Unit Number
Performing Organization Name(s) and Address(es) School of Advanced Air Power Studies Air University Maxwell AFB, FL 36112		Performing Organization Number(s)
Sponsoring/Monitoring Agency Name(s) and Address(es)		Monitoring Agency Acronym
		Monitoring Agency Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes		
Abstract		
Subject Terms		
Document Classification unclassified		Classification of SF298 unclassified
Classification of Abstract unclassified		Limitation of Abstract unlimited
Number of Pages 114		

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COMBINING SEQUENTIAL AND CUMULATIVE AIR STRATEGIES FOR
VICTORY:

THE PAST INFORMS THE FUTURE

BY

COURTNEY A. DUCHARME

A THESIS PRESENTED TO THE FACULTY OF
THE SCHOOL OF ADVANCED AIRPOWER STUDIES
FOR COMPLETION OF GRADUATION REQUIREMENTS

SCHOOL OF ADVANCED AIRPOWER STUDIES

AIR UNIVERSITY

MAXWELL AIR FORCE BASE, ALABAMA

JUNE 2000

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ACKNOWLEDGEMENTS

I would like to acknowledge several people without whose support and guidance this study would have remained at the conceptual level. In particular I gratefully thank Dr. Harold Winton, whose laser-guided insights frequently dispelled the fog of war in my poor, muddled head. The most inspiring part of working this effort with Dr. Winton was his morale was always high and he had the strength of ten because his heart was pure. I would also like to express gratitude to Colonel Dennis Drew, who patiently suffered my convoluted logic and grammar forays into uncharted territory. The opportunity to study under these gentlemen's tutelage was rare and appreciated.

I dedicate this thesis to my patiently enduring husband and children who deserve far more attention than I gave to them this past year. Without their kind tolerance, my SECOND master's thesis would never have been completed—which is only to observe that they bore the burden this second treatise with even more aplomb than the first. I hope the wish of my five-year old daughter, Christi, will soon come true . . . she said on many occasions, “Mommy, I wish you only had one page to read and one page to write tonight.” Here's to reading and writing only one page a night!

ABSTRACT

This study analyzes how sequential and cumulative aspects of air strategies interact to contribute to victory in war. The thesis uses as a point of departure the 1967 writing of Admiral J.C. Wylie, *Military Strategy: A General Theory of Power Control*. In this book Wylie describes two basic military strategies, sequential and cumulative. The sequential strategy consists of a “series of visible, discrete steps, each dependent on the one that preceded it.” A cumulative strategy is “the less perceptible minute accumulation of little items piling one on top of the other until at some unknown point the mass of accumulated actions may be large enough to be critical.” This study provides a preliminary analysis about the interaction of such aspects of air strategy by examining three historical campaigns: the Battle of Britain (from the German perspective), the Combined Bomber Offensive, and the Southwest Pacific Area campaign. The study outlines the historical context in which air strategies in these campaigns were conducted and describes the sequential and cumulative aspects of the air strategies. Next the thesis examines the nature of the relationships or interactions between both types of air strategies and whether those interactions contributed to achieving victory. The historical evidence from the three cases shows that each air strategy contained both sequential and cumulative aspects. Also, where the air planners appreciated the effects of both types of strategies, it was clear that there was an effort on their part to ensure the sequential air strategy aided the cumulative and vice-versa. Conversely, where the air planners had a

more limited appreciation for the effects of the sequential and cumulative air strategies, the interactions between the two were negative. That is, the sequential strategy hindered the cumulative and vice versa. Here the negative relationship between the two strategies did not contribute to victory in the air campaign. The broad conclusion is that air planners should appreciate the effects of both types of strategy and how those strategies can interact positively to create conditions that can promote victory in war. A secondary conclusion is that although the cumulative aspects of air strategy are frequently more subtle than are the sequential, air planners ignore those effects at their peril.

Chapter 1

Sequential and Cumulative Air Strategies: The Context

Strategy...can and should be an intellectual discipline of the highest order, and the strategist should prepare himself to manage ideas with precision and clarity and imagination in order that his manipulation of physical realities, the tools of war, may rise above the pedestrian plane of mediocrity. Thus, while strategy itself may not be a science, strategic judgment can be scientific to the extent that it is orderly, rational, objective, inclusive, discriminatory, and perceptive.

—J.C. Wylie

Theory is drawn from two sources: other theory and analysis of experience. A useful example is Sir Julian Corbett's theory of maritime strategy, which is derived from the theoretical works of Carl von Clausewitz and Alfred Thayer Mahan and Corbett's own analysis of England's maritime campaigns. In the same spirit, airpower theory can benefit from consideration of previous theorists as well as from historical analysis. This study will examine Admiral J.C. Wylie's theory of military strategy in light of several historical air strategies.

Admiral J.C. Wylie is a little-known military theorist who in 1967 wrote Military Strategy: A General Theory of Power Control. Wylie was an American naval officer possessing not only significant operational skills, but also well-considered ideas about military theory and strategy.¹ Wylie's Naval War College education and his later position as an instructor at the Naval War College prompted him to contemplate theory, strategy, and operational patterns. As a result of study and debate at the Navy's School for Advanced Study in Strategy and Sea Power, established at the Naval War College in 1951, Wylie fashioned the intellectual underpinnings of two strategies classifying them as sequential or cumulative. According to Wylie, each strategy could in some measure control the pattern of the war and, therefore, ultimately control the enemy.²

¹ John B. Hattendorf, introduction to *Military Strategy: A General Theory of Power Control* by J.C. Wylie (Annapolis, Md: Naval Institute Press, 1967), ix.

² J.C. Wylie, *Military Strategy: A General Theory of Power Control* with an introduction by John B. Hattendorf (Annapolis, Md: Naval Institute Press, 1967), 22.

Definitions of Sequential and Cumulative Strategies

Wylie defined sequential strategy as a “series of discrete steps or actions, with each one of this series of actions growing naturally out of, and dependent on, the one that preceded it.”³ Thus, a sequential strategy is temporally interdependent to the extent one step’s success relies upon the success of previously executed operations. In contrast, cumulative strategies are not sequentially interdependent. Rather, individual actions result in “an isolated plus or minus” and their effects constitute single statistics unrelated in time to other operations. In cumulative strategies, it is the sum total of individual effects that facilitates the strategist’s arrival at the final result.⁴ In one sense, the two strategies exist in contrast to each other, representing the far ends of a strategic continuum along which they are logically positioned. However, sequential and cumulative strategies are not necessarily mutually exclusive; on the contrary, in many instances the strategies may be closely inter-related. These conceptual relationships will be explained in some detail in the following chapter.

The Question at Hand

Wylie postulated that cumulative strategies have long been a characteristic of sea warfare and *may* be a characteristic of air warfare.⁵ However, he also observed that there were no writings that consciously differentiated cumulative warfare from sequential, nor any firm recognition of the strengths and weaknesses of the contrasting strategies. Despite this lack of scholarship, the air strategist might profitably consider sequential and cumulative strategies and their possible implementation in air operations. Based upon Wylie’s definitions of sequential and cumulative strategies and assuming that there is an interaction between sequential and cumulative air strategies, the research question under examination is: how do the sequential and cumulative aspects of an air strategy interact to contribute to victory or defeat in war?

Examining this question is a valuable pursuit for the modern air strategist. Specifically recognizing the existence of two separate air strategies and their interactions

³ Ibid., 22.

⁴ Ibid., 23.

⁵ Ibid., 25.

exposes the air analyst to new possibilities for exercising his strategic skills when planning air operations. If the air strategist neither understands the nature of sequential and cumulative strategies and their interactions, nor how they manifest themselves in air operations, then he constrains his ability to use either or both strategies to achieve victory. Wylie opined, “Our strategic success in the future may be measured in great part by the skill with which we are able to balance our sequential and cumulative efforts toward the most effective and least costly attainment of our goals.”⁶ Wylie intimated that not only is an understanding of sequential and cumulative strategies helpful to prevail in warfare, but it is also a salient issue for two other reasons. First, thoroughly comprehending the values and methods of sequential and cumulative strategies allows the strategist consistently to apply the law of economy of force. Second, it may also allow him more effectively to shape the peace that follows war.⁷

In response to the research question, “How do the sequential and cumulative aspects of an air strategy interact to contribute to victory or defeat in war?” we must consider six possible relationships:

- 5 The sequential air strategy aids the cumulative air strategy.
- 6 The sequential air strategy hinders the cumulative air strategy.
- 7 The sequential air strategy has no interaction with the cumulative air strategy.
- 8 The cumulative air strategy aids the sequential air strategy.
- 9 The cumulative air strategy hinders the sequential air strategy.
- 10 The cumulative air strategy has no interaction with the sequential air strategy.

Methodology

Chapters Three through Five will present case histories from World War II that examine the interactions between sequential and cumulative air strategies. Chapter Three will explore the Battle of Britain from the German perspective. This analysis prompts the air strategist to consider a failed campaign and thus determine if a lack of complementary effects between sequential and cumulative aspects in air strategy may have contributed to defeat.

⁶ Ibid., 26.

⁷ For an explanation of the law of economy of force, see J.F.C. Fuller, *The Foundations of the Science of War* (London: Hutchinson & Co., 1926), 194-207. For an explanation of the “better state of peace,” see B.H. Liddell Hart, *Strategy*, 2nd rev. ed. (New York: Meridian, The Penguin Group, 1991), 322, 349-350, 353-360.

Chapter Four investigates the Combined Bomber Offensive (CBO) in the European theater. The CBO provides an opportunity to explore how sequential and cumulative air strategies supported or failed to support the larger European theater strategy.

Chapter Five examines air strategy in the Pacific theater with special emphasis on the Southwest Pacific Area (SWPA). The nature of the Pacific theater, including its unique geography and its ranking in Allied grand strategy shaped General Kenney's choice of airpower strategies. The Southwest Pacific campaign provides an interesting case study to examine how sequential and cumulative strategies were combined in a different way to support gaining Pacific theater objectives.

There will be a standard approach for each historical case. First, each chapter will provide a description of the political, economic, and military context for the air strategies. Second, each case will identify strategic assumptions political and military leaders made that affected their choice of overall theater and air strategies. Third, each scenario will describe both sequential and cumulative aspects of the air strategies, who formulated them, and how they fit into the broader theater strategy. Finally, the analysis of the evidence will identify if and how sequential and cumulative characteristics of the air strategies interacted to contribute to success or failure.

Chapter Six will explore trends among the cases that might indicate broadly applicable generalizations about how sequential and cumulative aspects of air strategies interact to produce victory or defeat, and the implications for future airpower employment.

Chapter 2

Sequential and Cumulative Air Strategies: The Concepts

There are actually two very different kinds of strategies that may be used in war. One is the sequential, the series of visible, discrete steps, each dependent on the one that preceded it. The other is cumulative, the less perceptible minute accumulation of little items piling one on top of the other until at some unknown point the mass of accumulated actions may be large enough to be critical.

—J.C. Wylie

The Sequential Strategy

According to Wylie, strategists normally consider warfare to be a series of discrete steps or actions, one following another. In this series of actions, the order and results of previous events bear directly upon the operations and results of subsequent events.⁸ For example, a second step will depend necessarily upon the first step, the third step upon the results of steps one and two, and so forth. The totality of actions grows to be the series of events the strategist considers to be the sequence of war. Like the syntax of a language, in which the order of individual words ultimately influences the meaning of those words and the message of the entire sentence, the sequential strategy is inherently bound to a particular order of events. While individual operations themselves have intrinsic value, the dependence of subsequent actions upon previous actions is a primary characteristic of a sequential strategy.

This view of strategy and warfare is not only intuitive, it also dominates the history of strategic practice. Examples of sequential strategies include the Napoleonic Wars in Europe and many World War II campaigns including the German drive through the Soviet Union, the American offensive from French beaches to the heart of Germany, and

⁸ J.C. Wylie, *Military Strategy: A General Theory of Power Control* with an introduction by John B. Hattendorf (Annapolis, Md: Naval Institute Press, 1967), 22.

the American campaigns through the South and Central Pacific theaters of operations. In each of these examples there was a series of identifiable steps leading to a final objective. These strategies were also characterized by a physical goal, a decisive battle or series of battles, a denouement, and an identifiable victory or defeat.

There are several characteristics of a sequential strategy. In contrast to a cumulative strategy where a particular operation's failure does not necessarily dictate abandoning the course of the strategy, because every step of a sequential strategy depends upon the success of every previous step, the course of a war can change radically when there is an unforeseen failure or an unanticipated event. For example, during World War II, the Japanese heavily reinforced their forward base Rabaul, using it to threaten the sea lines of communication between the United States and Australia, as well as employing it as a base from which to threaten Australia proper. When the Allies captured bases in New Guinea, destroyed much of the Japanese navy at the Battle of Bismark Sea, and gained control of the Solomon Islands in a series of amphibious operations, the Japanese at Rabaul were cut off and no longer able to project power forward.⁹ Japan's inability to reinforce its outward reaches signaled a change in the course of the war. For the first time, the Japanese moved from an offensive to a defensive/holding strategy in the Southwest Pacific.

Related to the first characteristic of sequential strategies is the ability to predict, or at least anticipate, the outcome of a series of events, since the final objective is the clear result of a series of steps.¹⁰ For example, it was clear to the Allies that the Anglo-American drive from Normandy would end somewhere in the heart of Germany and that the Soviets would converge on Germany from the east at roughly the same time.

The Cumulative Strategy

A cumulative strategy is the logical converse of a sequential strategy. It is a collection of events, actions, or individual effects, the sum of which bears upon the enemy in such a manner as to bring about the strategy's ultimate purpose.¹¹ To illustrate

⁹ Thomas E. Griffith, Jr., *MacArthur's Airman: George C. Kenney and the War in the Southwest Pacific* (Lawrence: University Press of Kansas, 1998), 236-238.

¹⁰ Wylie, 24.

¹¹ Wylie, 23.

the effect with a physical example, imagine that the objective is to fill a bucket with water so that it overflows. Imagine also that the strategist has at his disposal various sizes of small measuring utensils he might use to scoop up water and fill the bucket. Each individual measurement of water the strategist adds to the bucket is an event that contributes to the overall strategic goal. Individually, the amount of water he adds at any particular time might be small. Also, the measuring instruments do not have to be the same size. Some may be teaspoon size, others tablespoon size, still others a large cup, depending upon the size of the resources available to the strategist. The sequence in which these portions are added is of no consequence. But, with sufficient measures of water added, eventually the bucket will overflow. Thus, cumulative strategies consist of individual events, each of which has an effect, and the summation of effects brings the strategist to his objective.

Wylie suggests two historical examples of cumulative strategies: the submarine warfare campaigns in both the Atlantic and Pacific oceans against the Germans and Japanese during World War II.¹² In the Atlantic case, the cumulative strategy was twofold: build more shipping and sink more German submarines. The Allied ability to do both eventually doomed the German anti-shipping strategy (also a cumulative strategy) to defeat. In the case of Japan, almost nine of ten million tons of available cargo shipping were sunk, having substantially adverse effect upon the Japanese economy.¹³ Allied anti-shipping strategy was supplemented by another cumulative strategy in the firebombing operations executed by Twentieth Air Force. The Allies hoped the accumulation of effects upon Japan's war economy would be devastating to Japan's warmaking potential.

Cumulative strategies have certain characteristics that distinguish them from sequential strategies. First, unlike sequential strategies, cumulative strategies consist of individual actions or events, and their effects are independent of time and position. In a cumulative strategy events do not depend upon the results of previous actions. Instead, each event has an isolated value that contributes to the final strategic result. Second, the effects of cumulative strategies are more difficult to predict than those of sequential

¹² Ibid., 23.

¹³ Ibid., 23-24.

strategies. While a cumulative strategy can be very effective, it is difficult to determine exactly when and in what manner the effects will make a difference to the enemy's ability to resist. Thus, measuring a cumulative strategy's effectiveness while it is in progress is problematic. Third, while sequential strategies frequently end in a decisive battle or series of battles, cumulative strategies typically work in the background, less spectacularly, with slow, steady pressure. Because sequential strategies are more intuitively understood and their conclusions are more readily anticipated, the cumulative strategy's value is sometimes overlooked and under-appreciated. Wylie asserts that sea power has long been characterized by cumulative strategies (*guerre de course*, in particular) and speculates that the case may be the same for airpower.¹⁴

Interactions between Sequential and Cumulative Strategies

Sequential and cumulative strategies are distinct in their nature; however, they seldom exist in isolation. Indeed, Wylie asserts that the two strategies complement each other. He argues that in many instances cumulative strategies working in the background provide sufficient pressure upon the enemy to enable the success of a sequential strategy. Absent the compounding effects of cumulative strategies, many weaker sequential strategies may have failed. Wylie cites the Yorktown Campaign, the Peninsula Campaign in Portugal, and the American Civil War as examples of such interaction.¹⁵

Interactions between sequential and cumulative air strategies are of some import to the air strategist. Rather than leaving such synergies to chance, examining and determining the nature of those interactions based upon historical evidence may contribute to air strategists' future success. As Wylie notes, the strategist should:

¹⁴ Ibid., 25.

¹⁵ Ibid., 25.

Recognize the existence and power of cumulative strategies and integrate them more carefully into basic strategic thinking. Also, study the strategies more closely than we have in order that we might be able to determine whether or not they profitably could be critical. And if they could, then identify the points in their development at which they do become critical determinants in the progress of war.¹⁶

By understanding characteristics and interactions between sequential and cumulative strategies, the air strategist can effectively use sequential and cumulative air strategies with ground and maritime strategies to exert maximum force against the enemy.¹⁷

Levels of Analysis: Perspective Matters

Determining sequential or cumulative aspects of an air strategy may depend upon the perspective from which it is examined. For example, during the 1991 Persian Gulf War, initial operations were characterized by intensive air strikes against Iraq. The Joint Forces Air Component Commander (JFACC), General Charles Horner, orchestrated a strategy with both sequential and cumulative aspects at the operational level. First, Iraqi integrated air defenses were neutralized as an intermediate step to conducting a cumulative attacks across the depth and breadth of Iraq against leadership, system essential, infrastructure, population, and fielded force targets. While at the operational level, the air strategy combined a sequential step followed by very definite cumulative operations. At the strategic level the air strategy reflected predominantly sequential characteristics. General Norman Swartzkopf placed the effects of the cumulative air strategy sequentially prior to a ground invasion of Iraq and Kuwait. His intention was that the cumulative effects of air strikes between 16 January and 23 February would aid

¹⁶ Ibid., 26.

¹⁷ A perceptive observer might note one particular shortcoming in Wylie's construct of sequential and cumulative strategies. It is based on a false dichotomy. Wylie's sequential strategy is defined in the realm of time—one event follows another. The logically correct antithesis of a sequential strategy is not a cumulative strategy, but a simultaneous strategy—one in which various operations are taking place in parallel, rather than sequential, increments of time. (For more information about parallel warfare, see John A. Warden, *The Air Campaign* (New York: Excel, 1998), 144-161.) Conversely, Wylie's cumulative strategy is defined in the realm of effects—the final result is an accumulation of various effects. The logically correct antithesis of a cumulative strategy is not a sequential strategy, but a discrete strategy—one in which the individual effect of each action is thought to bring victory. Despite this logical flaw at the heart of Wylie's typology, his construct does have analytical and interpretive value because the mechanisms by which his sequential and cumulative strategic patterns work are practically and experientially distinct. The sequential strategy rests on an interdependence of the sequence of events while the cumulative pattern does not.

the subsequent ground invasion on 23 February. In other words, beginning the cumulative portion of the air strategy prior to the ground invasion was not only sequential in time, at the strategic level there was a logical and causative relationship between the two phases of the war. This brief example clearly demonstrates that combat actions appearing cumulative at one level of analysis can appear sequential when placed into a broader context. The salient point is that the level of analysis bears upon the interpretation of cumulative and sequential air strategies.

The interactions between sequential and cumulative strategies will first be examined in the case of the Battle of Britain from the German perspective. In the Battle of Britain, the Germans failed to establish the air superiority required to launch an invasion of the British homeland. In examining the German strategies as they were executed in the air war over Britain, the analyst can identify both sequential and cumulative aspects. The case will provide evidence of how particular interactions or the absence of such interactions between the two types of strategy failed to lead to victory.

Chapter 3

Sequential and Cumulative Air Strategies in the Battle of Britain: the German Perspective

The Battle of Britain, by contrast, was to be a truly revolutionary conflict. For the first time since man had taken to the skies, aircraft were to be used as the instrument of a campaign designed to break the enemy's will and capacity to resist without the intervention or support of armies and navies.

—John Keegan

American and British histories of World War II both assert that in the spring and summer of 1940 British strategists had to consider seriously the probability that Hitler planned to invade Britain.¹⁸ Against the backdrop of successful German actions in Austria, Czechoslovakia, Poland, Norway, Belgium, and France Britain was obligated to treat Nazi Germany as a direct threat. If Hitler's plans to attack Britain were to succeed, it was essential that the Luftwaffe establish and maintain air superiority over the English Channel and the southeast coast of Great Britain. To understand the Luftwaffe's air strategy during the Battle of Britain, it must be considered in its political, military, and economic context. Equally as important, the goals and strategic assumptions of Hitler, the Wehrmacht, and the Luftwaffe also influenced German air strategy. The air strategy Germany pursued throughout the Battle of Britain contained both sequential and cumulative aspects. The task of the following analysis is to examine the interaction of these aspects of German air strategy in the framework of their wider strategic context.

¹⁸ Winston S. Churchill, *The Second World War. Their Finest Hour*, (Boston: Houghton Mifflin Company, 1949), 321. Basil Collier, *The Defense of the United Kingdom*, History of the Second World War, publication of the United Kingdom Military Series, ed. J.R.M. Butler, (London: Her Majesty's Stationery Office, 1957), 120. Richard Hough and Denis Richards, *The Battle of Britain: The Greatest Air Battle of World War II*, (New York: W.W. Norton and Company, 1989), 104-110, 265-266, 308. E. Kathleen Williams, "Air War, 1939-1941," in *The Army Air Forces In World War II. Vol. 2, Plans and Early Operations. January 1939 to August 1942*, ed. Wesley Frank Craven and James Lea Cate (Chicago: University of Chicago Press, 1948), 87, 91-94. Derek Wood and Derek Dempster, *The Narrow Margin: The Battle of Britain and the Rise of Air Power 1930-1940*, rev. ed. (Washington D.C.: Smithsonian Institution Press, 1990), 140, 258.

Political, Economic, and Military Contexts

The Political Context

At the highest level, Germany's surprise at the rapid conclusion of fighting in France put Hitler in a position for which he was unprepared.¹⁹ Following Germany's swift victories in Poland, Norway, Belgium, and France, the British alone remained able to contest Germany's control over Western Europe in 1940. Hitler hoped that Britain would come to terms after witnessing German successes on the Continent. Following the British Expeditionary Force's (BEF) evacuation from Dunkirk, Hitler and the Luftwaffe's Commander-in-Chief, Reich Marshal Herman Göring were sure Churchill would sue for peace.²⁰ However, the stridency of Hitler's diplomacy and the ruthlessness of his warmaking in the late 1930s and 1940 were fundamentally antithetical to both British values and interests. This made the possibility that Britain would accept Germany's terms for peace or even enter into negotiations very remote indeed.

Hitler also failed to understand the British character, political climate, and military capability. German intelligence sorely misjudged British political inclinations and military capabilities leading Hitler to underestimate British resolve and power. An inconsequential, but vocal, Fascist minority in Britain led Hitler to believe that the British people were ready to rise up and overthrow the government. Hitler was convinced that after the British people toppled the Churchill government and installed their chosen Fascist regime, Britain might be persuaded to join with Germany or at least offer no active resistance to German control of the Continent.²¹

The Economic Context

Germany's ability to win the Battle of Britain was directly connected to its economic mobilization. Hitler's unwillingness to put the Germany economy on a wartime footing constrained its ability to produce aircraft platforms in the numbers necessary to support

¹⁹ Collier, 147. Adolf Galland, *The First and the Last: The Rise and Fall of the German Fighter Forces, 1938-1945*, translated by Mervyn Savill (New York: Henry Holt and Company, 1954), 18. Albrecht Kesselring, *The Memoirs of Field Marshal Kesselring*, translated by William Kimber Limited, 1953, 3rd ed. (London: Greenhill Books, 1997), 83. Williams, 94-96.

²⁰ Wood and Dempster, 157-158.

²¹ Ibid., 156-157.

an air campaign against Britain.²² Within the Luftwaffe itself, decisions made by General Ernst Udet, director of aircraft production, failed to drive the aircraft industry to turn out what it was potentially capable of producing. Lacking the economic focus found later in the war, Germany's aircraft numbers in 1940 were far below what was required to prevail in the Battle of Britain.²³

In another decision to produce the largest number of aircraft platforms at a specified level of economic investment, Germany had in 1937 postponed development of four-engine, long-range, heavy bombers.²⁴ In forgoing the development of a heavy bomber, and thus limiting the amount of munitions tonnage the Luftwaffe was able to deliver against Britain, Germany further constrained its strategic options.²⁵ By calling for the largest striking force in the minimum of time and with limited investment, Hitler's economic decisions shaped the Luftwaffe's force structure.²⁶ That force structure in turn influenced the success of both sequential and cumulative air strategies in the Battle of Britain.

The Military Context

Germany's quick victories over Poland, Norway, Belgium, and France led Hitler to believe the Wehrmacht would prevail in a struggle with Britain. In the case of the Luftwaffe, the head of intelligence made several misleading and inaccurate assessments of British air forces including underestimating British fighter performance, pilot skill, leadership flexibility, aircraft production and maintenance infrastructure, and the robust nature of the air defense network.²⁷ It was upon this faulty intelligence estimate Hitler and Göring based their strategy for the Battle of Britain.

Given Hitler's hopes to avoid further direct conflict with Britain, several high ranking German leaders, including Germany's Secretary of State in the Commissariat for Air, Field Marshal Erhard Milch; Commander of Luftflotte 2, Field Marshal Albert

²² Richard Overy, *Why the Allies Won* (New York: W.W. Norton & Company, 1995), 182, 198-201. Albert Speer, *Inside the Third Reich. Memoirs by Albert Speer* (New York: MacMillan Company, 1970), 214. Gerhard L. Weinberg, *A World at Arms. A Global History of WWII* (New York: Cambridge University Press, 1994), 182, 194, 471.

²³ Wood and Dempster, 25.

²⁴ Williams, 92. Wood and Dempster, 21.

²⁵ Wood and Dempster, 20-21, 25, 29.

²⁶ *Ibid.*, 20.

Kesselring; and Luftflotte 2 fighter pilot Adolf Galland doubted Hitler's full commitment to the invasion of Britain.²⁸ According to German accounts, the plans exhibited none of the detail previous campaigns contained, even though an amphibious invasion increased the coordination requirements between service arms.²⁹

While Hitler may have entertained unfounded political hopes, he was persuaded by more pragmatic concerns to prepare for the worst case—that which would pit Germany against Britain in open hostilities. Hitler made contingency plans to prepare and execute Operation Sea Lion, an amphibious invasion of Great Britain. As early as 29 November 1939, Hitler anticipated the possibility of open hostilities between Germany and Britain. Hitler issued a directive which outlined occupying the Belgian and French coastlines in order to pursue a blockade of Britain by sea and air.³⁰ Unfortunately, at the conclusion of the Battle of France, the German Army and Navy were not well prepared to commence an immediate assault upon Britain. On 24 May 1940, Hitler issued a further directive, which stated that following the defeat of France and until Operation Sea Lion could be executed the Luftwaffe should commence independent operations against the British Isles.³¹ This was followed by a June order from Göring, that Luftflotten 2, 3, and 5 should prepare to execute attacks “against industry and air force targets which have weak defensive forces.”³² In addition, Hitler's mid-July Directive 16 ordered that, “As England, in spite of the hopelessness of her situation, has shown herself unwilling to come to a compromise, I have therefore decided to begin to prepare for and if necessary carry out, an invasion of England. The aim of this operation is to eliminate the English motherland as a base from which war against Germany can be continued and if necessary, to occupy the country completely.”³³ The directive went on to assign to the Luftwaffe its role as linchpin in the operation by tasking it to destroy the RAF, attack Royal Navy forces at their home bases, overcome coastal defenses, break resistance of

²⁷ Wood and Dempster, 66-67. Hough and Richards, 141.

²⁸ Galland, 18, 20-21, 31. David Irving, *The Rise and Fall of the Luftwaffe, The Life of Field Marshal Erhard Milch* (Boston: Little, Brown and Company, 1973), 97-98. Kesselring, 65-69, 72-73, 82-83.

²⁹ Kesselring, 67.

³⁰ Hough and Richards, 109, Wood and Dempster, 65.

³¹ Hough and Richards, 109. Williams, 94. Wood and Dempster, 158-159.

³² Wood and Dempster, 158.

³³ Hough and Richards, 110. Wood and Dempster, 160.

ground troops, annihilate reserve forces, and destroy lines of transport.³⁴ As a result, Göring's Luftwaffe staff met on 21 July to outline detailed requirements for the air offensive. This air strategy would be fundamentally different from any the Luftwaffe had executed to date.

To prevail over Britain, Germany's Luftwaffe faced several challenges. In doctrine, equipment, and training, the Luftwaffe was unprepared to execute a campaign of independent air operations against Britain.³⁵ Since 1933, Luftwaffe doctrine, equipment, and training focused on building itself as a ground-support arm.³⁶ While Germany's 1935 air doctrine *Luftwaffe Regulation 16* addressed all air missions including strategic air operations, these were envisioned in the context of combined arms warfighting.³⁷ As a continental power, the Luftwaffe's execution of independent strategic attack missions was not as heavily emphasized as the offensive use of light and medium bombers for interdiction and close support of ground troops.³⁸ The Luftwaffe experience in the Spanish Civil War, Poland, Norway, Belgium, and France appeared to validate their doctrinal choices for predominantly executing ground support air missions and procurement of specific aircraft for those missions. The Luftwaffe did conduct independent bombing operations against Rotterdam and Warsaw; however, in each of these cases the cities were easily within range of Germany's light and medium bombers. Also, since enemy air forces posed no substantial threat to the Luftwaffe, Hitler remained convinced that extant bombers and fighters were adequate to prosecute the war.³⁹

In each of the conquered nations, the Luftwaffe primarily operated in support of the German Army by quickly overcoming enemy air forces and providing support for advancing German ground troops. In terms of equipment, Germany possessed light and medium bombers with relatively limited load capacities. The Heinkel 111, Dornier 17, Junkers 87, and Junkers 88 were all single or two-engine bombers, ideal for operations in

³⁴ Irving, *The Rise and Fall of the Luftwaffe*, 96. Wood and Dempster, 160.

³⁵ Williams, 96.

³⁶ John Keegan, *The Second World War* (New York: Viking, 1990), 91.

³⁷ James S. Corum and Richard R. Muller, *The Luftwaffe's Way of War. German Air Force Doctrine 1911-1945* (Charleston: Nautical and Aviation Publishing Company of America, 1998), 121-122.

³⁸ Richard J. Overy, *The Air War 1939-1945* (Chelsea, Mich: Scarborough House, 1980), 103. Hough and Richards, 309.

³⁹ Benjamin Franklin Cooling, *Case Studies in the Achievement of Air Superiority* (Washington, D.C.: Government Printing Office, 1994), 33. Dempster and Wood, 23-25. Overy, *The Air War*, 10, 103. Weinberg, 576. Williams, 88-89, 91-92.

coordination with ground elements or for high altitude dive bombing attacks against pinpoint targets.⁴⁰ German fighter aircraft existed as a reluctant admission that some defensive protection might be needed.⁴¹ The German Messerschmitt 109 and 110 fighters lacked sufficient speed (in the case of the 110), range, and adequate numbers for Germany to pursue independent air operations against a formidable foe such as they would meet in the Battle of Britain.⁴² For example, the most effective German fighter, the Messerschmitt 109, was not as maneuverable as the British Spitfire, had a combat radius of only 125 miles, a maximum speed of 350 miles per hour (not substantially greater than the Spitfire) and could remain airborne for only 60 to 90 minutes. The Me 110 was not as capable as the Me 109 and flew considerably slower than the British Spitfire. The Luftwaffe's doctrine, training, and equipment may have been well suited to Continental operations; however, it would face a different enemy in Britain, for which it was not ideally suited.

In the Battle of Britain, the numbers of aircraft and aircrew available to each side were important elements the German leadership took into account as they formulated their air strategies. Since the battle came down to achieving air superiority, both sides assigned overwhelming value to the number and type of fighter aircraft in their inventories. In the period prior to the German invasion of France, known as the Phony War, both Britain and Germany conserved their resources.⁴³ On the eve of the battle, the Luftwaffe had almost a 1.5:1 advantage in the number of fighters available.⁴⁴ Luftwaffe and British Fighter Command fighter strength is available at Appendix 1. Germany attempted to formulate an air strategy that would exploit the Luftwaffe's strengths: larger numbers of aircraft and pilots, superior tactics, recent battle experience, and the capabilities of its most advanced fighter, the Messerschmitt 109.

⁴⁰ Hough and Richards, 47.

⁴¹ Galland, 14-15. Wood and Dempster, 22.

⁴² Wood and Dempster, 148-149, 335-336.

⁴³ Wood and Dempster, 29.

⁴⁴ Collier, 161-162, 452, 464-465. Hough and Richards, 112. Irving, *The Rise and Fall of the Luftwaffe*, 99. Alfred Price, *Battle of Britain: The Hardest Day. 18 August 1940*, (New York: Charles Scribner's Sons, 1979), 16-17, 212-213. Wood and Dempster, 164, 180, 196, 344-345, 354-355.

Strategic Options

Option One

Germany had two options to eliminate Britain from the war. Executing the first military strategic option would have been unique to that point in the history of warfare. If the Luftwaffe could bring airpower to bear directly upon the military, economic, and moral resources Britain depended upon to wage war, a ground invasion might not be necessary. Here the Luftwaffe's air operations during the Battle of Britain "led to uncharted fields of air strategy."⁴⁵ In this option Hitler foresaw Germany conducting independent air operations that would concurrently isolate Britain economically and break the morale of the British people and government by total air warfare.⁴⁶

The first argument that recommended this option was that by avoiding a full-scale invasion, Germany could save its Army troops for Continental operations, especially the contemplated invasion of Russia. Second, an independent Luftwaffe operation was much simpler to plan than an amphibious landing and invasion. Also, Germany had an advantage (almost 1.5:1) in the air in terms of numbers of fighter aircraft.⁴⁷ Another positive aspect of this option was that if the independent air campaign alone failed to intimidate Britain, it might at least create the preconditions necessary to conduct an invasion.

The argument against this option pointed to the lack of evidence that such a strategy would prove successful, despite what early air theorists and imaginative authors envisaged. If this option were chosen, the Luftwaffe would have included a wide array of targets including ports and shipping to isolate Britain economically, population centers, a wide array of industrial targets including the aircraft industry, and British military targets outside the immediate southeast coastal area to affect British morale. Hitler did not choose this option, preferring instead to plan for the worst case, that a full invasion would be necessary.

⁴⁵ Galland, 64.

⁴⁶ Ibid., 12.

⁴⁷ Cooling, 149.

Option Two

In a second option, a force-on-force direct-assault scenario, Hitler could defeat Britain by conducting an amphibious landing and invasion. The military strategy was straightforward: use the Luftwaffe to destroy Britain's Fighter Command as an effective force, overcome the Royal Navy in the Channel, defeat coastal defenses, and occupy airfields in Britain allowing the Luftwaffe to support German ground operations across the entirety of Britain.⁴⁸ This option was attractive because a full invasion, if it were successful, would decisively eliminate Britain from the war.

However, there were several difficulties with this option. Unlike Continental operations in Poland, Norway, Belgium, and France, the execution of an amphibious invasion would require complicated operations and logistics coordination between Army, Navy, and Air Force. The Army and Navy were as yet unprepared to invade Britain. Detailed plans had not yet been drawn up; moreover, Army and Navy forces had to be reconstituted after the Battle of France. According to Navy Grand Admiral Erich Raeder, the Navy would not be prepared to bring Army troops to England until at least 15 September, just a few weeks before fall and winter weather closed in making an amphibious landing impossible.⁴⁹ Another difficulty was that the German Navy alone would be no match for the Royal Navy.⁵⁰ Therefore, Germany would have to gain air supremacy over the Channel and the invasion front in order for the Luftwaffe to protect German naval and ground assets against Royal Navy and Air Force threats.

Luftwaffe operations would be driven by the primary assumption that air supremacy was necessary before sea supremacy could be gained—and that air and sea supremacy were necessary for a successful ground invasion of the British homeland.⁵¹ For the Germans to gain air supremacy, their operational objective was to destroy Britain's Fighter Command and gain freedom of action over the Channel and Britain. Luftwaffe targets in this option would be British aircraft production industry, fighters, fighter command bases, and the supporting communications and maintenance facilities.

⁴⁸ Ibid., 69-70, 159.

⁴⁹ Hough and Richards, 137.

⁵⁰ Kesselring, 73.

⁵¹ Churchill, 319. Collier, 159. Galland, 12, 20. Hough and Richards, 109, 245, 327. Williams, 94. Wood and Dempster, 160, 162.

Germany chose to execute this option, presuming that occupying Britain would secure a victory. Hitler's Directive Number 16 confirmed the Luftwaffe's role as the critical link in the invasion project because of the preparatory air supremacy missions it would perform as Army and Navy plans were crafted and forces gathered.⁵²

Sequential Air Strategy in the Battle of Britain

From the British perspective, the Battle of Britain officially lasted from 10 July until 31 October 1940. From the German perspective, this campaign was sequential in several respects. At the military strategic level, the air campaign as a whole was sequential because it was a prerequisite for Germany to execute Operation Sea Lion. Hitler, the German High Command, Göring, and Headquarters Luftwaffe clearly recognized the necessity to gain air superiority over both the Channel and a broad invasion front prior to commencing naval and ground operations. Achieving such superiority demanded destruction, or at least neutralization, of the Royal Air Force Fighter Command. At the operational level, the air campaign was also sequential: the Luftwaffe envisioned two sequential stages. First, the fighter defenses and defense organizations in southern Britain would be annihilated. After eliminating pressure from the south and gaining freedom of action in one sector, operations would move northward and inland to complete air supremacy.⁵³ This was the plan. However, as operations unfolded, there were actually five sequential phases, each phase shaped by the results of the previous. One observation may be in order. In Wylie's definition of a sequential strategy, one step builds upon the success of the previous step. Ironically, in the Battle of Britain, the sequential air strategy might more accurately be characterized by the fact that later steps were built upon the failure of previous steps, rather than their success.

Phase One: Kanalkampf, 10 July – 7 August 1940

The first phase, Kanalkampf or Channel Battle, was marked by the German's lodgment of forces at airfields along the Norwegian, Dutch, Belgian, and French coasts,

⁵² Hough and Richards, 109.

⁵³ Hough and Richards, 137. Irving, *The Rise and Fall of the Luftwaffe*, 96.

from which extensive bomber and fighter operations threatened Britain.⁵⁴ Luftflotten 2 and 3 were based as indicated on the map at Appendix 2. Each Luftflotte contained bombers, dive-bombers, fighters, and reconnaissance aircraft. This phase of the campaign began with German bomber raids in strengths of 20 or 30 aircraft against shipping convoys, southern ports and towns, and nighttime minelaying. The purpose of attacks upon ports and seaside towns was to inflict “violent attacks to unsettle the whole country.”⁵⁵ Germany intended to squeeze the British economy; close the channel to both Royal Navy and commercial transit; wear down Fighter Command as it attempted to protect British shipping; and begin to apply pressure upon southern British towns including Plymouth, Weymouth, Falmouth, Portsmouth, and Dover.⁵⁶ Such attacks were consistent with both Göring’s and Hitler’s expectation that the British would yield to Germany’s airpower pressure. Göring specifically intended to use the few bombers sortied as bait for Fighter Command aircraft to venture out over the Channel.⁵⁷ Göring believed that if Fighter Command could be brought into battle, German Me 109s and 110s could engage and destroy them. However, the Germans quickly found the Royal Air Force (RAF) was not easily lured into such engagements. Though one of their duties was protecting British shipping, British fighter commanders deliberately refused battle in order to conserve British planes and aircrews for defending more important targets.⁵⁸

As time passed, the Luftwaffe realized that coastal raids and anti-shipping operations would not provoke Fighter Command to engagements on terms favorable to the Germans. There was no way to achieve air superiority over either the Channel or Southern England if these operations were maintained.⁵⁹ Thus, on 1 August, Hitler issued Directive Number 17, which drove the second phase of the campaign.

⁵⁴ Galland, 19.

⁵⁵ Ibid., 97.

⁵⁶ Hough and Richards, 110-111. David Irving, *Göring: A Biography* (New York: William Morrow and Company, Inc., 1989), 294. Keegan, 94. Wood and Dempster, 170-185.

⁵⁷ Galland, 25.

⁵⁸ Irving, *The Rise and Fall of the Luftwaffe*, 99.

⁵⁹ Galland, 28. Kesselring, 70.

Phase Two: Operation Eagle or the Classic Phase, 8 Aug – 23 Aug 1940⁶⁰

In terms of a sequential air strategy, phase two was necessary not because of the success of phase one, but because of its failure. In the second phase, Germany pursued offensive air operations that more closely accorded with Douhet's edict that the best way to annihilate the enemy's air force was while it was on the ground.⁶¹ Thus, Hitler's 1 August 1940 Directive 17 and Göring's Luftwaffe implementing instructions directed air operations "primarily against Fighter Command flying units, ground installations, supply organizations, and aircraft industry."⁶² However, Hitler added two important caveats: the Luftwaffe had to remain battle-worthy to execute Operation Sea Lion and was forbidden to target London or other civilian targets in terror attacks. There is some difference of opinion about whether Directive 17 provided an appropriate level of prioritization for targets. German Field Marshal Erhard Milch asserted the directive did not go far enough in concentrating attacks upon the most lucrative targets to achieve air superiority, i.e. British radar towers.⁶³ However, there were further Luftwaffe instructions indicating that attacks against British radar installations should occur at the outset of phase two.⁶⁴

Göring called this phase Operation Eagle and designated 13 August as "Eagle Day." Göring believed that a three-day full press operation against British airfields and radar stations would destroy Fighter Command and allow the invasion to take place four weeks later.⁶⁵ According to a German High Command directive, Hitler would decide whether Operation Sea Lion would take place in 1940 based upon the results of Göring's operations.⁶⁶

In this phase the Luftwaffe used its bomber force more extensively than it had in the first phase of the battle. There were, however, competing demands for bomber employment. Bombers would be needed both to lure British fighters into the air and to defeat Fighter Command on the ground. At the same time, German bombers could not afford high losses because the Luftwaffe needed to preserve forces for the follow-on Sea

⁶⁰ Keegan, 94.

⁶¹ Galland, 38.

⁶² Hough and Richards, 137. Irving, *Göring: A Biography*, 294. Wood and Dempster, 163. Price, 31-32.

⁶³ Irving, *The Rise and Fall of the Luftwaffe*, 98-99.

⁶⁴ Hough and Richards, 137-138. Wood and Dempster, 163.

⁶⁵ Cooling, 95. Irving, *Göring: A Biography*, 294. Irving, *The Rise and Fall of the Luftwaffe*, 96. Wood and Dempster, 196.

Lion invasion.⁶⁷ In the beginning of Operation Eagle, fighters would accompany bombers in a “free chase over southeast England” to destroy airborne Hurricanes and Spitfires that were not already neutralized on the ground by German bombers.⁶⁸ Fighter Command air-to-air battle losses reflected how successfully German fighters used their speed advantage and advanced tactics to wreak havoc with British Hurricanes and Spitfires.⁶⁹ During this phase, the Luftwaffe exacted a loss of 192 aircraft from Fighter Command. At the same time, German losses increased from 181 in phase one to 397 in the second phase and bomber losses in particular went from 6% in July to 19.6% in August.⁷⁰ As German bomber losses skyrocketed, Göring’s frustration peaked and he ordered Messerschmitt fighters to provide close escort for the slower moving bomber formations in the hope of providing better protection. By constraining the fighters’ tactical maneuvers, the Luftwaffe High Command actually made both German fighters and bombers more vulnerable to British fighters.⁷¹ What Hurricane and Spitfire fighters lacked in speed against the Messerschmitts, they made up for in maneuverability. In curtailing their speed, German fighters could not execute tactics best suited to their aircraft, thus making themselves vulnerable targets. Once the Me 109s were dispensed with, British fighters were free to prey upon the Luftwaffe’s bombers at will.

As it was, critical sector radar stations and airfields in southeast Britain were barely operating at some points during this phase. This had serious ramifications for how efficiently the British were able to employ the few aircraft they had available to meet the German onslaught. The number of British pilots were dwindling at such a rate that, even if the British had sufficient numbers of fighter aircraft, they would not have had the necessary number of trained pilots to fly the aircraft.⁷² The other school of thought asserts that even if the Luftwaffe had correctly chosen radar and airfield targets and pursued them persistently, there were two insurmountable difficulties. First, the

⁶⁶ Hough and Richards, 137-140.

⁶⁷ Price, 14.

⁶⁸ Galland, 23.

⁶⁹ Wood and Dempster, 320.

⁷⁰ Collier, 450-492. Williamson Murray, *Strategy for Defeat, The Luftwaffe 1933-1945* (Maxwell AFB, Ala: Air University Press, 1983), 43.

⁷¹ Hough and Richards, 235. Irving, *The Rise and Fall of the Luftwaffe*, 99-101. Price, 14. Wood and Dempster, 204, 320.

⁷² Hough and Richards, 236, 248-251. Irving, *The Rise and Fall of the Luftwaffe*, 104. Keegan, 102.

Luftwaffe seriously misjudged the munitions concentration that would be necessary to achieve the desired effects.⁷³ Equally as important, there simply were not enough German aircraft, either bombers or fast Me 109 fighters, to destroy enough of Fighter Command and achieve the air superiority the Germans assumed as a necessary condition to invade Britain.⁷⁴

Phase Three: The Airfield Phase, 24 Aug – 6 Sept 1940⁷⁵

As phase two resulted from the failure of phase one, so also was phase three the outcome of adjustments deemed necessary because of the perceived failure of phase two. During what John Keegan described as “the airfield phase” of the Battle of Britain, the Luftwaffe continued targeting British airdromes and aircraft factories as opposed to shipping and harbor targets in order to continue Fighter Command's attrition.⁷⁶ However, Göring significantly revised the air tactics he employed.⁷⁷ First, the Luftwaffe reduced bomber formations in size to preserve bombers for Operation Sea Lion. Göring discontinued the use of the Stuka dive-bomber (Ju 87) altogether because of the debilitating losses suffered during Operation Eagle.⁷⁸ Also, the Germans began to use fighters in a dual role as bombers. Instead of acting in a pursuit or escort role, the fighters were fitted with bombs for hitting airfields and factories. The changes in tactics threw British defenses into confusion.⁷⁹ Finally, because Göring anticipated poor weather conditions, the Luftwaffe increased night bombing of industrial targets around cities to disrupt supplies necessary for the RAF to continue operations. Still, Göring reserved the right to order attacks upon London itself.⁸⁰

There is still some controversy over whether this third phase could have been decisive for the Germans. One argument is that continued bombing of British radar and forward airfields belonging to Fighter Command would have so weakened British air defenses that within three more weeks, Britain would have been unable to resist

⁷³ Galland, 30. Kesselring, 79.

⁷⁴ Price, 183.

⁷⁵ Keegan, 94.

⁷⁶ *Ibid.*, 96.

⁷⁷ Williams, 95.

⁷⁸ Wood and Dempster, 212, 226.

⁷⁹ Kesselring, 78-79.

⁸⁰ Hough and Richards, 223.

Operation Sea Lion.⁸¹ However, an unforeseen event drastically changed the course of the campaign. During this phase, the Germans ran into difficulties with poor weather and night bombing. On 24 August, a German bomber ran off course and mistakenly dropped its bombs upon London itself, making it the first time since 1918 that Central London was damaged in an air attack.⁸² The strategic decisions that followed had enormous ramifications for the outcome of the Battle of Britain. In reprisal, the British commenced a series of long-range bombing runs targeting Berlin's industrial and communication targets. British bombing, like German, also suffered from inaccuracy that resulted in damage to residential property and some deaths.⁸³ Outrage prompted Hitler and Göring to change the Luftwaffe's air strategy again, ultimately easing the pressure on Fighter Command's overtaxed resources.

In the meantime, the difficulty the Luftwaffe faced in gaining air superiority took its toll on the plans for Operation Sea Lion. On 3 September, Field Marshal Wilhelm Keitel, Chief of Staff of the Wehrmacht, issued a new schedule for Sea Lion launch preparations. The earliest date for Army landings on Britain was delayed from 15 to 21 September.⁸⁴ This decision was in part because Göring had as yet failed to gain air superiority and because the British had begun bombing canals necessary to move invasion barges from interior parts of Germany to the French coast. Still, Sea Lion preparations continued, and the order to launch the invasion was scheduled to be released 13 September.

Phase 4: The Battle of London

In considering the characteristics of a sequential air strategy, the reader will recall that because one step of the strategy depends upon the success (or as the German strategy perhaps demonstrates, the failure) of the previous step, frequently the course of wars changes unexpectedly when there is an unforeseen failure or an unanticipated event. In the case of the Battle of Britain, the Germans did not intend to bomb London on 24 August, nor were they strategically prepared for the ramifications of that accident. When Britain responded in kind with bombing raids against Berlin, both Hitler and Göring lost

⁸¹ Irving, *Göring: A Biography*, 295. Hough and Richards, 248-251. Wood and Dempster, 71.

⁸² Hough and Richards, 224. Irving, *The Rise and Fall of the Luftwaffe*, 101. Wood and Dempster, 229.

⁸³ Wood and Dempster, 232.

⁸⁴ Hough and Richards, 245.

political face. Hitler and Göring had consistently and publicly assured the German population that the Wehrmacht and Luftwaffe, the Fatherland's protectors, were invincible. The worst medicine to swallow was to have Bomber Command successfully reach Berlin and prove both the Führer and the Reich Marshal wrong. In the minds of Hitler and Göring, such an affront required an appropriate response from Germany. Thus, Hitler removed restrictions against bombing London, and Göring moved from Holland to France to oversee the Battle of London personally.⁸⁵

During the Battle of Britain's fourth phase, the Luftwaffe began daylight bombings of London proper as well as aircraft industries close to London and other British cities.⁸⁶ The Germans used London's proximity to the Thames estuary to aid navigation. In the case of other targets, the Germans used a set of intersecting radio beams as navigational aids to find isolated industrial targets.⁸⁷ The change in strategy was not only in retaliation for British bombings. In addition, Göring and Kesselring believed that by attacking London, they could force the remainder of Fighter Command into engagements to be finally destroyed. Finally, as German military strategy noted, a grand assault upon London would perhaps create sufficient chaos to terrorize the British into submission without having to execute Operation Sea Lion.⁸⁸

Initial German attacks were successful because the British did not realize that incoming bombers and fighters would bypass the airfields and hit the national capitol. As a result, British fighters were initially slow to intercept the Germans. Göring took this to indicate that the British Fighter Command had been significantly attrited. However, after the British adjusted their tactics and correctly anticipated the new German *schwerpunkt*, the Luftwaffe suffered grave losses at Fighter Command's hands. On 15 September the Luftwaffe sent its largest raiding force and saw its most spectacular defeat, losing 60 aircraft to the British 26.⁸⁹ German fighter pilots were demoralized and frustrated with the constantly changing orders that they took to be evidence of no clear German

⁸⁵ Galland, 41. Hough and Richards, 245. Irving, *Göring: A Biography*, 295.

⁸⁶ Hough and Richards, 294. Keegan, 96. Williams, 95. Wood and Dempster, 70, 264.

⁸⁷ Hough and Richards, 268.

⁸⁸ Hough and Richards, 244-245. Irving, *The Rise and Fall of the Luftwaffe*, 105. Wood and Dempster, 267.

⁸⁹ Hough and Richards, 366. Irving, *The Rise and Fall of the Luftwaffe*, 106. Keegan, 101. Wood and Dempster, 271-272.

strategy.⁹⁰ More importantly, the heavy losses convinced Hitler that air superiority could not be achieved in 1940. On 17 September, the Führer postponed Operation Sea Lion indefinitely.⁹¹

Phase 5: The Blitz

Faced with mounting losses, the Germans switched tactics in this phase from predominantly daylight bombing to high altitude night attacks of London. Germany withdrew even more of the longer-range bombers (Heinkels and Dorniers) from the campaign to preserve them for future use in upcoming operations against Russia—where range was a critical factor. Instead of traditional bombers, the Luftwaffe employed fighter-bombers at high altitude at night.⁹² The aircraft were very difficult to identify on radar and practically impossible to intercept. The effect upon London was again intended to demoralize the population and maintain continued pressure on the British. As for Operation Sea Lion, Hitler ordered preparations to continue for the purpose of maintaining political pressure on England. He then added, “Should the invasion be reconsidered in the spring or early summer of 1941, orders for a renewal of operational readiness will be issued later. In the meantime, military conditions for a later invasion are to be improved.”⁹³ On that sentiment, night bombings continued through the end of the Battle of Britain.

Summarizing Sequential Air Strategy in the Battle of Britain

The critical characteristic of a sequential strategy is that actions are temporally interdependent. Decisions made or operations undertaken in one instance will have direct bearing upon the success of future operations. The German strategy in the Battle of Britain was sequential in that it attempted to defeat Britain’s Fighter Command and gain air superiority by moving from the southeastern edge of Britain northward and from the Channel westward. In the final analysis, if the sequential aspect of German air strategy depended upon a series of interdependent actions that would result in Britain’s

⁹⁰ Hough and Richards, 275.

⁹¹ Hough and Richards, 273, 283. Irving, *The Rise and Fall of the Luftwaffe*, 106-107. Kesselring, 75. Wood and Dempster, 274.

⁹² Galland, 53. Williams, 95-96.

capitulation, the sequence was flawed. Flaws existed at the grand strategy level that influenced the resources available to execute the sequential strategy. The Luftwaffe also made mistakes at the operational level by making unwise decisions in moving from one phase to the next.

At the grand strategy level, sluggish economic mobilization limited the numbers of bomber and fighter aircraft available to execute the operational level air strategy. The process of building up the Luftwaffe's strength in numbers of aircraft platforms proceeded at a "leisurely pace" with production factories working in low gear.⁹⁴ The fact that German industry had not been sufficiently mobilized in 1940 (or even earlier) to feed a wartime appetite, meant later decisions in the sequential air strategy were inconsistent and untenable given the levels and types of resources available.

Second, at the grand strategic level the Luftwaffe failed to understand that aircraft design choices made in the mid-1930s would have far-reaching effects upon its ability to execute wartime air strategies in 1940. In reality, Germany's choice of aircraft and their technical characteristics directly influenced their probability of success. For example, the Luftwaffe delayed developing a long-range, heavy bomber. As a result, German bomber crews were unable to reach certain targets and could not carry heavy bomb loads to the targets they did reach. Lack of sturdy defensive armament left the aircraft vulnerable to British fighters. In short, the Luftwaffe was at a great disadvantage in delivering ordnance on targets without the benefit of long-range, heavy bombers.⁹⁵

German fighter aircraft suffered from similar handicaps. In the case of the tactically capable Me 109 fighter, its limited combat radius barely allowed German pilots to conduct operations over London. A short combat radius and negligible loiter time over the critical portion of the battlespace precluded German isolation of the battlefield, making establishment of air superiority extremely difficult.⁹⁶ Since the sequential strategy depended upon successfully delivering bombs on target and engaging Fighter Command aircraft wherever possible, the strategy was incompatible with earlier aircraft design choices.

⁹³ Hough and Richards, 301.

⁹⁴ Wood and Dempster, 164.

⁹⁵ Kesselring, 76.

⁹⁶ *Ibid.*, 68.

At the operational level, the Luftwaffe's poor intelligence analysis led Göring to miscalculate badly the direction and effects of each phase. Because German intelligence failed to analyze British air defenses and order of battle information adequately, the Luftwaffe's decisions during the execution of individual phases and their transitions to new phases were fundamentally flawed. A misunderstanding of the roles of radar and sector station operations meant the Luftwaffe could not accurately grasp the very successful effects of phases two and three. Had the Germans successfully interpreted the effects of their attacks during Operation Eagle and the airfield phases, they would have understood their best probability for success was persisting in those attacks. In addition, the Germans failed to identify which airfields belonged to Fighter Command as opposed to other British commands such as Coastal Command and Training Command.⁹⁷ As a result, the Luftwaffe did not concentrate effects appropriately upon Fighter Command airfields. In failing to persist, lacking concentration, and incorrectly gauging Fighter Command's true strength, the Luftwaffe's decisions to move from one phase to the next were less rooted in the reality of the situation than they were in wishful thinking.

Cumulative Air Strategy in the Battle of Britain

On the surface, the German phasing of operations from the Channel coast to inland areas and from the southeast to the north of Britain was sequential in character; however, there existed an underlying cumulative logic to the character of Luftwaffe air strategy in the Battle of Britain. The operational objective throughout the campaign remained constant: achieve air superiority. The means of achieving this objective also remained constant: destroy Fighter Command. To succeed, each sequential phase should have attrited Fighter Command to bring about the cumulative effect of its ultimate destruction. Considered from this perspective, the cumulative strategy determined which force could continue fighting despite the losses of both aircraft and aircrew. The prevailing air force would be that which could attrite its adversary either because it was more efficient or because it had larger resources upon which to draw. If the analyst examines the air strategy from this perspective, there are cumulative aspects not only among the

⁹⁷ Hough and Richards, 214-215, 309.

operations within each phase but also between phases that transcend the sequential aspects of Germany's air strategy.

Phase One: Kanalkampf, 10 July – 7 August 1940

Within phase one Luftwaffe air strategy was cumulative in nature because no one engagement was necessarily a precursor to successive engagements; instead, the effects of destroying individual convoys, harbors, and ports accumulated as well as the losses of fighter aircraft and pilots in both the British and German air forces. However, the Germans found the total accumulated effects of these operations within the phase were not sufficient either to force Britain to sue for peace or to destroy Fighter Command. They therefore surmised that the phase could not achieve the precondition necessary for Operation Sea Lion. During phase one, German strategy failed to attract a sufficient number of British fighters to engagements because Luftwaffe targets were shipping convoys, harbors, and selected southern ports. British air leaders conserved fighter resources from being expended over what they judged to be relatively insignificant targets.⁹⁸ During this phase, only 72 British Fighter Command aircraft were destroyed at a cost of 181 German aircraft.⁹⁹ The best data available for aircraft indicate the British had 708 aircraft available in Fighter Command and were producing approximately 500 more from their fighter aircraft production lines in July.¹⁰⁰ The Germans had approximately 1089 fighter aircraft but could only add 220 more from July's production lines.¹⁰¹ While the British appreciated the need to husband their fighter resources by producing sufficient numbers of aircraft to infuse into front line action and build up a significant reserve, the Germans did not or could not follow suit.

Victory not only depended upon aircraft, but also upon pilots. In July the Germans lost approximately 125 fighter pilots or about 11% of their total pilot pool. In comparison, the British lost approximately 168 pilots or 15% of their total pilot

⁹⁸ Wood and Dempster, 196.

⁹⁹ Collier, 450-492.

¹⁰⁰ Collier, 161-162, 452, 464-465. Hough and Richards, 112. Irving, *The Rise and Fall of the Luftwaffe*, 99. Overy, *The Air War 1939-1945*, 33. Price, 16-17, 212-213. Wood and Dempster, 164, 180, 196, 344-345, 354-355.

¹⁰¹ Overy, *The Air War*, 33.

numbers.¹⁰² Extracting data from the start and finish of the phase shows German Me 109 aircrew availability for operations went from 81% to 85%, for Me 110s from 84% to 83%, and for bombers from 75% to 70%. The British enjoyed a slightly higher percentage of ready aircrew with 86% and 88% available at the beginning and end of the phase.¹⁰³ If the Germans intended to destroy Fighter Command, the relative aircraft and aircrew strengths would have to change. With only 72 British fighters downed, it was not difficult for the Germans to recognize that the Kanalkampf phase would not cause the destruction of Fighter Command. Therefore, Hitler and Göring widened the conflict, choosing targets that would force Fighter Command to commit to battle. If the Germans had been able to use intelligence and battle damage assessment tools better, they also might have realized that if aircraft platform attrition and production trends continued, the German strategy had a poor probability of success.

Phase Two: Operation Eagle or the Classic Phase, 8 Aug – 23 Aug 1940¹⁰⁴

For the Luftwaffe to have a better idea of its progress toward the goal of destroying Fighter Command, its leaders had to be aware of and measure the operational and strategic repercussions emanating from their air strategy's cumulative aspects. First, the Germans had to realize that while individual attacks during Operation Eagle were independent in nature, their effects combined together to give that phase its own character at the operational level. In turn, the nature of the effects from Operation Eagle should have been considered along with the gains and losses associated with Kanalkampf phase to make considered judgments at the military strategic level. While Göring may have partly recognized the influence from cumulative aspects of his air strategy upon his own forces, there is little evidence that the Germans fully understood effects of the cumulative aspects of their air strategy upon the British—at either the operational or strategic level.

As Operation Eagle commenced, individual sortie statistics for aircraft and aircrew losses compounded at the operational level. During this phase the targets concentrated attacks along the southeast coast and were designed to increase Fighter Command's losses. The Luftwaffe's air strategy was cumulative in nature inside the phase with

¹⁰² Cooling, 99. Wood and Dempster, 347.

¹⁰³ Murray, 51. Wood and Dempster, 348.

independent operations against flying units, ground installations, supply organizations, and aircraft industry. For example, Biggin Hill operations were not dependent upon the success of Luftwaffe attacks upon Dover. Also, the Luftwaffe continued to execute anti-shipping operations by attacking convoys, harbors, and minelaying. These assaults were complementary efforts and not dependent upon the success of the main attacks.¹⁰⁵

Cumulative effects also could be observed at the strategic level. During Operation Eagle the British began losing aircraft at a significant rate; however, Luftwaffe successes did not come cheaply. During this phase, the British lost 192 aircraft in comparison to the Luftwaffe losing 397. Adding the losses for each combatant to those incurred during the Kanalkampf phase shows the accumulated effect at the strategic level of 264 British losses to 578 German losses.¹⁰⁶ At the same time, accumulating fighter production for the Germans at 557 (June through August) paled in comparison to the British production of 1,418 for the period.¹⁰⁷ Therefore, from the strategic perspective, the British continued to out-produce and husband more aircraft platforms than the Germans. Comparative Luftwaffe and Fighter Command aircraft strengths on 8 August were 1,029 German fighters and 714 British fighters with German strength falling to 926 by the end of the phase.¹⁰⁸ Therefore, fighter aircraft attrition showed a trend that favored the British as long as they continued to produce significantly more platforms and maintain favorable loss ratios.

In the case of fighter pilots, during this phase the Germans lost a much smaller percentage (15%) of their total pilots than did the British (26%).¹⁰⁹ For the price of 168 German pilots, the Luftwaffe wiped out 237 Fighter Command pilots. The British were not in an advantageous position with their combined losses of pilots since the beginning of the campaign at 321 as opposed to 292 German pilots lost.¹¹⁰ This trend might have favored the Germans since the percentage of operationally ready aircrews declined for

¹⁰⁴ Keegan, 94.

¹⁰⁵ Irving, *The Rise and Fall of the Luftwaffe*, 96.

¹⁰⁶ Collier, 450-492.

¹⁰⁷ R.J. Overy, *The Air War*, 33.

¹⁰⁸ Collier, 161-162, 452, 464-465. Cooling, 92, 102. Galland, 55. Hough and Richards, 112. Irving, *The Rise and Fall of the Luftwaffe*, 99. Overy, *The Air War*, 33. Price, 16-17, 212-213. Wood and Dempster, 164, 180, 196, 344-345, 354-355.

¹⁰⁹ Cooling, 99. Wood and Dempster, 347.

¹¹⁰ Cooling, 99.

Fighter Command; however, the Luftwaffe would have had to increase their operational crew readiness by producing more pilots.¹¹¹

The Germans may have understood the effects of aircraft and aircrew attrition on their own forces as their aircraft losses had significantly increased and aircrew readiness decreased. However, poor battle damage assessments and inadequate intelligence analysis contributed to a lack of understanding concerning the cumulative aspect of Luftwaffe air strategy upon the British. The Germans did not identify Fighter Command's relatively steady aircraft strength in comparison to the Luftwaffe's waning numbers. Nor did the Luftwaffe identify a lucrative area to exploit: Britain's growing difficulties with fighter pilot loss rates. The primary driver for Göring's change in targets and tactics was increasing German aircraft attrition. The Luftwaffe began flying at higher altitudes and fighters were ordered to provide closer escort for the bombers. Also, the Germans began to withdraw Stuka dive-bombers from the campaign as their losses increased. In the meantime, as winter weather approached less time remained available for the Luftwaffe to secure air superiority and support Sea Lion.¹¹²

Phase Three: The Airfield Phase, 24 Aug – 6 Sept 1940¹¹³

Similar to previous phases, effects from this set of attacks reflected aspects of a cumulative air strategy at the operational and strategic levels. At the operational level, independent sortie results combined together cumulatively for a total effort characterizing the airfield phase. At the strategic level, airfield phase operations, in combination with the cumulative effects from the Kanalkampf and Operation Eagle phases, served to increase pressure upon both the Luftwaffe and Fighter Command. Luftwaffe leadership decisions reflected a limited cognizance of the tolls continued aircraft and aircrew losses exacted from the Luftwaffe's ability to pursue its objective. Göring was desperate to obtain some valuable result from each sortie as oncoming winter weather threatened to close the window for the proposed invasion.¹¹⁴ However, if the Luftwaffe had a glimmer of the air strategy's cumulative effects upon German forces, it did not appear to

¹¹¹ Murray, 51. Wood and Dempster, 348.

¹¹² Wood and Dempster, 151.

¹¹³ Keegan, 94.

¹¹⁴ Hough and Richards, 223.

appreciate the accumulating burdens the British suffered. This lack of understanding led Göring to abandon what was perhaps the most effective operational phase of the campaign.

During the airfield phase, target sets remained the same; however, the Germans' focus moved inland to airdromes and aircraft factories, and used new tactics to protect their bombers from prohibitive losses.¹¹⁵ The Germans lost a total of 380 aircraft in this phase as a result of independent air actions. Since the beginning of the campaign, the Luftwaffe had accumulated a total loss of 958 aircraft.¹¹⁶ For the second time the Germans showed alarm at the rate of their losses, and not only because of fighter losses. Bomber attrition threatened to weaken the Luftwaffe's strength to the point that it would be unable to support Sea Lion when, and if, it was launched.¹¹⁷ As a result of the losses, the Germans reduced the size of their bomber formations and increased fighter escorts.¹¹⁸ Also, because of continuing high Stuka losses, Göring completely removed Ju-87s from the fight to preserve them for the invasion.¹¹⁹ These changes in tactics demonstrate that the Luftwaffe was, at least at the operational level, paying attention to their accumulating losses. However, at the strategic level British fighter aircraft production continued to outstrip the Germans 2:1, ultimately giving Fighter Command deeper resources from which it could replace British aircraft losses.¹²⁰ The Germans had not made such an adjustment to account for their aircraft attrition. Also, at the strategic level, the Germans intelligence and battle damage assessment process failed to understand the critical role of British airfield sector operations rooms or capture the cumulative effects of Luftwaffe attacks upon those stations during phases two and three.

Like Operation Eagle, this phase was costly for the British, adding significantly to accumulating losses. The number of fighters was the most important aircraft variable in the contest for air superiority; and Fighter Command was hit particularly hard, losing 290 fighters, while of the Luftwaffe 380 aircraft lost, only half were fighters.¹²¹ Also, the functional utility of fighters depended upon sector operations rooms and radar warnings.

¹¹⁵ Williams, 95.

¹¹⁶ Collier, 450-492.

¹¹⁷ Wood and Dempster, 226.

¹¹⁸ Williams, 95.

¹¹⁹ Wood and Dempster, 226. Price, 179.

¹²⁰ R.J. Overy, *The Air War*, 33.

According to British Group 11 Commander, Air Vice Marshal Keith Park, had Germany continued attacks on sector operations rooms at airfields, the fighter defenses would have been powerless to oppose heavy attacks either against London or full invasion.¹²² Worse than the wastage of aircraft were the fighter pilot casualties. In comparison with the British statistics of 26%-28%, the Germans enjoyed a lower pilot attrition rate with 15%-23% of their pilots taken out of action.¹²³ Britain continued to produce pilots; however, they could not long sustain the August and September loss rates that outstripped gains.¹²⁴ New pilots assigned to Fighter Command were vulnerable until they became battle-tested, and a decline in the number of operational aircrews resulted. With fewer experienced pilots, Fighter Command losses gave the Command a poor showing against its German counterpart. From July through September, the British lost a total of 585 pilots as opposed to 520 pilots lost by the Germans during the same period.¹²⁵

Had the Luftwaffe had an appreciation for the accumulating pressure it was placing upon British sector operations rooms and Fighter Command pilots, it might well have continued this phase of the Battle of Britain and achieved a strategic victory. However, the Germans' lack of intelligence about British vulnerabilities, coupled with concern to mitigate their own losses, prompted them to change their strategic focus. This immediately released the pressure upon Britain's Fighter Command.¹²⁶ By reducing the strain on the British fighters and their radar warning system, the Luftwaffe was unable to gain its military objective—the destruction of Fighter Command.

Phase 4: The Battle of London

As the Germans moved into the Battle of London phase of the campaign, the cumulative aspects of German air strategy bore more heavily upon German aircraft and aircrew, while relieving the British of the worst pressure. The Luftwaffe targeted London areas instead of the airfield sector stations. German aircraft losses were almost twice the British score, 433 to 242 with the total accumulation of 1,391 German losses to 792

¹²¹ Keegan, 96.

¹²² Wood and Dempster, 257.

¹²³ Cooling, 99. Wood and Dempster, 347.

¹²⁴ Wood and Dempster, 256.

¹²⁵ Cooling, 138.

¹²⁶ Keegan, 102.

British.¹²⁷ The single engine fighter production trend continued with the British producing 467 to the German 218 aircraft. In total since July, Fighter Command was the grateful beneficiary of 1,885 fighter aircraft—over 1000 more than the German war machine provided the Luftwaffe in the same period.¹²⁸ The combined effects of aircraft production and losses from July through September placed the British almost on par with the Germans in fighter aircraft strengths. Fighter Command could now confidently face the time remaining until winter closed in with 665 fighters against a depleted Luftwaffe stock of 800.¹²⁹ Again the Germans coped with their aircraft attrition by changing tactics. Göring ordered all Me 110s to be escorted by Me 109s. Also, attacks were to be concentrated upon aircraft industry vice the radar stations, which the German's mistakenly believed to be unsuccessful.¹³⁰

The remaining portion of the attrition picture was fighter pilot strength. Casualties continued to bedevil the British who lost 28% of their pilot strength with 270 casualties in comparison to the 230 pilots lost, a 23% loss rate for Germany. However, by the end of September, British operational aircrew readiness showed 91% whereas German aircrew readiness hovered anywhere from 59% to 77%.¹³¹ Increased pilot production on the part of British Air Staff efforts helped put Fighter Command crew numbers in good stead against the Germans. In contrast, to avoid further officer losses, the Luftwaffe High Command ordered that no more than one commissioned officer be included in German bomber crews. This constituted another operational adjustment to guard aircrew from losses, but one that failed to address the problem at the strategic level.

At this point, even morale factors became important byproducts of the cumulative aspect of the air campaign strategy. That Fighter Command continued to survive to fight another month helped re-establish British morale.¹³² German aircrews experienced quite the opposite effect as their expectations were again disappointed. Although it is empirically difficult to measure morale, the German pilots apparently were suffering.

¹²⁷ Collier, 450-492. Williams, 95.

¹²⁸ Overy, *The Air War*, 33.

¹²⁹ Collier, 161-162, 452, 464-465. Cooling, 92, 102. Galland, 55. Hough and Richards, 112. Irving, *The Rise and Fall of the Luftwaffe*, 99. Overy, *The Air War 1939-1945*, 33. Price, 16-17, 212-213. Wood and Dempster, 164, 180, 196, 344-345, 354-355.

¹³⁰ Hough and Richards, 220.

¹³¹ Murray, 51. Wood and Dempster, 348.

¹³² Hough and Richards, 274.

“For well over two months the aircrews had been told that victory was just around the corner . . . failure to achieve any notable success . . . had a most demoralizing effect on the fighter pilots who were already overtaxed by physical and mental strain.”¹³³

Ultimately, the combined losses of the first four phases of the campaign meant the Luftwaffe’s failure to achieve air superiority. On 17 September Hitler postponed Operation Sea Lion indefinitely.

Phase 5: The Blitz

Although Hitler postponed Operation Sea Lion, he consoled himself with the belief that the invasion might be possible in the spring of 1941. With that thought, he did not yet want to end the air campaign and “preparations for “Sealion” [were] continued solely for the purpose of maintaining political and military pressure on England.”¹³⁴ Unfortunately for the Luftwaffe, the effects of continuing the air campaign were continuing pilot and aircraft losses that left the Luftwaffe at three quarters strength compared to the beginning of the Battle of Britain.¹³⁵ Strategically, the cumulative effect of the campaign left the Luftwaffe in significantly weakened condition to execute operations in other locations, including over Russia and in defense of the Reich itself.

To minimize losses during the Blitz, more operational-level adjustments were made including transitioning to night operations and withdrawing many Heinkel and Dornier bombers in favor of using Messerschmitts as fighter-bombers.¹³⁶ The Luftwaffe fitted 520 Me 109 and 110s to carry 100 and 500-pound bombs with the remaining Me 109s providing escort. Sinking morale continued to plague the German fighter pilots in this phase. First, the pilots resented their new fighter-bomber status as a “violation of [their] aircraft,” and more significantly, because they felt they were being treated as scapegoats for the Luftwaffe’s failure to cow Fighter Command. The fighter pilots believed they were being unjustly punished for having failed to protect Luftwaffe bombers by being forced to carry the bombs themselves. Also, in the compressed time left before weather completely shut down operations, bombing training was hurried and did not produce high

¹³³ Hough and Richards, 275.

¹³⁴ Ibid., 301.

¹³⁵ Galland, 55.

¹³⁶ Galland, 53. Keegan, 102. Williams, 95-96. Wood and Dempster, 290.

confidence in their bombing skills. The pilots were “annoyed at carrying cargo and glad to get rid of the bomb anywhere.”¹³⁷ The cumulative losses and operational fixes to counter those losses took their toll on pilot morale and operational effectiveness of those who continued the air campaign until its conclusion.

Losses during this last phase of the campaign continued several familiar trends. The Germans lost 318 aircraft for a total of 1,709 lost during the campaign. The British lost 144 for a total loss record of 936 aircraft.¹³⁸ Single engine fighter aircraft production trend continued with the Germans producing 144 aircraft to the British 469 aircraft. In sum, during the campaign England produced 2,354 fighters to Germany’s 919.¹³⁹ Most telling is the aircraft strength of both air forces. The British ended the campaign with approximately the same strength it began, as opposed to the Germans who lost about one quarter of their strength. No data is available for German fighter pilot losses in October; however, the British lost 165 more pilots for a total loss of 750.

Summarizing Cumulative Air Strategy in the Battle of Britain

The effects and logic of a cumulative air strategy underlay all five phases of the Battle of Britain both individually and in combination; however, the Luftwaffe’s ability to discern those effects and either plan for them or leverage them was problematic. Each phase contained operations that were independent in their nature, but whose effects accumulated at the operational level within that phase. Additionally, at the military-strategic level, cumulative aspects of German air strategy should have been a consideration as the Luftwaffe executed its air strategy.

The British awareness of the effects of a cumulative air strategy can be supported by direct evidence. For the British, victory was to stave off Luftwaffe attacks with Fighter Command until winter weather set in and precluded a German amphibious invasion. At both the strategic and operational levels, British leaders made decisions to safeguard Fighter Command’s strength as a “fleet in being.” In response to Dowding’s urgent warnings, Churchill withheld significant numbers of fighters from the Battle of France to

¹³⁷ Galland, 53.

¹³⁸ Collier, 450-492.

¹³⁹ Overy, *The Air War*, 33.

ensure there was sufficient fighter strength to protect Britain when necessary to do so.¹⁴⁰ Also, Dowding maintained a certain number of fighters in the Midland and northern sectors, out of the Luftwaffe's main line of attacks. These fighters not only defended against German air attacks in the north of England, as the Germans discovered on 15 August when they attempted to breach the northern border, but they also formed a strategic reserve for emergencies. Air Vice-Marshal Park, Air Officer Commanding of Number 11 Group, helped maintain losses at manageable levels by employing single and paired squadrons against the strongest of the Luftwaffe formations and rotating fatigued pilots out of direct action.¹⁴¹ Finally, Britain's ability to keep fighter aircraft and pilot production at consistently high levels recognized that early losses could be compensated by consistent investments in equipment and men.

Where the British fully appreciated the effects attendant with cumulative aspects of air strategy, the Germans failed to account fully for those effects—either in guarding against the negative or capitalizing on the positive. Some evidence indicates that the Germans did not wholly ignore the cumulative dimension of strategy. At the operational level, the Luftwaffe's changes in aircraft employment indicate its recognition some effort had to be made to stem the flow of losses of both aircrew and aircraft. Requiring closer escorts, flying at higher altitudes, switching to night operations, limiting the number of officers per aircrew, withdrawing Stukas from the campaign, and implementing the fighter-bomber concept demonstrate that the Germans knew they were suffering high levels of attrition and attempted to make adjustments. However, the Germans failed to appreciate the full effects of the cumulative air strategy and recognize that there were strategic-level decisions necessary to offset those effects. Despite Field Marshal Kesselring's claim in his memoirs that “even allowing for average losses of 30 to 50 percent, [they] were assured of regular replacements,” German staff actions failed to fulfill that promise.¹⁴² Low aircraft production rates imply that the Germans either had unwarranted confidence that large numbers of new aircraft would not be required or that they simply did not understand the effects of the cumulative air strategy.¹⁴³ Appendices

¹⁴⁰ Weinberg, 128. Wood and Dempster, 130-132.

¹⁴¹ Hough and Richards, 138, 333.

¹⁴² Kesselring, 84.

¹⁴³ Murray, 100.

1, 3, and 4 all indicate that the Germans experienced large levels of losses to their aircraft without commensurate effort invested in replacing those aircraft. As a result, the Luftwaffe's air strength throughout the Battle of Britain declined steadily in comparison to British air strength, which held up rather consistently.

Unlike the British, the Germans did not address the cumulative air strategy effects upon pilot attrition. For example, the Luftwaffe did not rotate pilots to relieve battle fatigue. Nor did German pilot production keep up with pilot attrition as shown in aircrew operational ready rates in Appendix 5. Despite higher losses for British fighter pilots, strategic level data trends between German and British pilot losses favored the British from July to September. British pilot attrition showed a decreasing rate of losses whereas German pilot attrition rates were increasing. The German trend does not include losses of Me 110 aircraft pilots whose data were unavailable. However, given the fact that during Operation Eagle Me 109 pilots were required to begin escorting Me 110 aircraft because of their high loss rates, there is a strong probability that Me 110 pilot losses also were increasing.¹⁴⁴ The table below, as well as Appendices 6 and 7 show British and German pilot loss trends. Despite the cumulative effects of attrition, British pilot production kept operational pilot strength at a far higher percentage than German pilot production could for German operational strengths. Even though the Luftwaffe was unwise to change their strategic targets between the airfield and Battle of London phases, they still could not underwrite German losses in the long run. The evidence shows that in attempting to destroy Fighter Command, effects of the cumulative aspect of the air strategy ultimately exacted a greater toll on the Germans than they did on the British.¹⁴⁵

¹⁴⁴ Wood and Dempster, 204.

¹⁴⁵ Price, 183.

Table 1
Fighter Pilot Losses: RAF Fighter Command and Luftwaffe Loss Trends

Month	RAF Fighter Command			Luftwaffe BF 109 Force		
	Total Losses All Causes	Delta Month to Month	Loss Trend	Total Losses All Causes	Delta Month to Month	Loss Trend
July	84	N/A		124	N/A	
August	237	153	+	168	44	+
September	276	39	-	229	61	+
October	165	-111	-	No data		

Source: Benjamin Cooling, *Case Studies in the Achievement of Air Superiority* (Washington D.C.: GPO, 1994), 99. Derek Wood and Derek Dempster, *The Narrow Margin* (Washington, D.C.: Smithsonian Institution Press, 1990), 347.

Interactions between Sequential and Cumulative Air Strategies in the Battle of Britain

Understanding how sequential and cumulative air strategies interacted during the Battle of Britain in part depends upon the level of analysis. At the level of German grand strategy, the Battle of Britain was a part of a sequential strategy to neutralize Britain before turning on the USSR. There was also a sequential logic to the military strategy. First, the Luftwaffe would have to achieve air superiority over the Channel and Southern England. Then, the German Army and Navy would commence Operation Sea Lion and invade Britain proper.

At the operational level, there was a mix of sequential and cumulative air strategies. On the one hand, there were sequential requirements for interdependent air operations. First, the Luftwaffe would have to effect a lodgment along the channel. Second, having successfully completed lodgment, individual air fleets would execute operations to gain superiority over the Channel. After securing freedom of action over the Channel, next would come air superiority over southeast England, followed by air superiority moving inland and northward. The types of aircraft and their technical limitations limited the Luftwaffe's ability to execute this sequential air strategy effectively. Instead of one phase depending upon the successful result of previous actions, the Luftwaffe moved to

the next phase because the previous phase failed in its objective or because the Luftwaffe perceived the phase had failed to reach its objective.

Underlying the sequential air campaign in the Battle of Britain was a cumulative logic. At its most basic level, the battle might be considered a protracted battle of attrition because the Luftwaffe strategy was to destroy Fighter Command and Fighter Command's strategy was to survive to fight another day.¹⁴⁶ On any particular day, the losses either side suffered failed to be decisive. Instead, losses accumulated bringing pressure to bear upon the leadership's choice of air strategy and its ability to influence the final outcome. The Luftwaffe failed to appreciate the full ramifications of the cumulative aspect of its air strategy and thus, made inappropriate decisions to move from one sequential phase to the next. In failing to understand the effects of the cumulative air strategy, the Luftwaffe abandoned the two most effective phases of the sequential strategy. A misunderstanding of the cumulative effects of their air strategy upon the British caused the Luftwaffe to make one sequential move too many. Moving from phase three to the Battle of London in phase four was probably a mistake on the part of the Luftwaffe based upon their poor understanding of the cumulative effects their attacks had made upon sector airfields. The validity of this observation is reinforced by the fact that Fighter Command could not afford to sustain such high aircraft losses and fighter pilot casualties. The Germans also failed to understand that operational level adjustments would not mitigate the strategic effects of their cumulative air strategy. The Luftwaffe suffered significant losses of both pilots and aircraft in each phase. However, the production levels of pilots and aircraft were never adjusted to account for those losses. Therefore, with each passing month the Luftwaffe became weaker as the British became stronger.

As mentioned earlier, in a campaign of attrition, the party that can operate with the best combination of efficiency and resource availability will prevail. Given the number of objectives the Luftwaffe needed to secure during the Battle of Britain, there are grave doubts that even if Luftwaffe leadership had a coherent cumulative air strategy, the resources available made executing the strategy very difficult.¹⁴⁷ However, had the

¹⁴⁶ Price, 179. Churchill, 338.

¹⁴⁷ Galland, 63-64.

Luftwaffe understood that if operational resources were limited they would have appreciated the need to execute each sequential phase with more cumulative efficiency and plan reinforcements at the strategic level. They would have had better insight into how the cumulative and sequential aspects of their air strategy might have been combined.

The Luftwaffe failure to think about the interrelationships between sequential and cumulative air strategies contributed to its failure. Neither the sequential aspects of Germany's air strategy supported the cumulative aspects, nor did the cumulative air strategy support the sequential. The Germans did not prevail in the Battle of Britain, in part, because the two strategies lacked coherent interaction. Moreover, it did not help that the Luftwaffe fought against an adversary whose centuries of sea power tradition had given it an almost intuitive appreciation for the logic of a cumulative strategy.

Though it failed, the Luftwaffe's experiences were open to examination and interpretation on the part of all the combatants. If the steps Germany took "led into uncharted fields of air strategy and became a hypothesis," then the next steps in proving the hypothesis were taken by the Allies.¹⁴⁸ Ironically, the Allies would pursue similar sequential and cumulative air strategies against Germany later in the war, but to better result.

¹⁴⁸ Ibid., 64.

Chapter 4

Sequential and Cumulative Air Strategies in the Combined Bomber Offensive

It is a conceded fact that OVERLORD will not be possible unless the German Air Force is destroyed. Therefore, my personal message to you—this is a MUST—is to, “Destroy the enemy Air Force wherever you find them, in the air, on the ground, and in the factories.

—General Hap Arnold, New Year’s Message issued December 1943

The heavy bomber offensive was an impersonal sort of war and monotonous in its own particular way. Day after day, as weather and equipment permitted, B-17s and B-24’s went out, dropped their deadly load, and turned homeward. Rarely was a single mission or series of missions decisive; whatever earlier theory had taught of sudden paralysis of a nation by strategic bombardment, in actual practice...the effects of the bombing were gradual, cumulative, and during the course of the campaign rarely measurable with any degree of assurance.

—Wesley Craven and James Cate, *The Army Air Forces in World War II*, 1949

When Germany declared war upon the United States in 1941, the United States was ill prepared to meet the Wehrmacht in a direct force-on-force ground battle. With the knowledge that vast amounts of equipment would be required to prevail over Axis powers, American government agencies such as the Office of Production Management, Controlled Materials Plan, and Manpower Commission, began gearing U.S. industry to initiate extensive wartime mobilization.¹⁴⁹ In the meantime, the Joint and Combined Chiefs of Staff (CCS) crafted military plans to employ forces, such as they existed, against Hitler’s Reich. Warplans for the European Theater of Operations (ETO) would take advantage of the requirements outlined in American Army Air Force’s Air War Plans Document 1 (AWPD-1) and 42 (AWPD-42), translating them into a capabilities

¹⁴⁹ Richard Overy, *Why the Allies Won* (New York: W.W. Norton & Company, 1995), 192-193.

plan to respond to German power.¹⁵⁰ Thus, the first military pressure Allied forces employed against Germany would be with airpower. The Combined Bomber Offensive (CBO), a culmination of planning efforts between the Royal Air Force's Bomber Command and the Army Air Forces, contained aspects of both sequential and cumulative air strategies. However, unlike Luftwaffe efforts during the Battle of Britain, Allied sequential and cumulative air strategies in the CBO successfully interacted to promote victory.

Political, Economic, and Military Contexts

The Political Context

British and American military staffs began meeting as early as January 1941 to discuss the strategies they would employ against German aggression. The ABC-1 meetings and American Rainbow 5 defense plan called for the maximum effort in strategic offensive operations against the European Axis powers. Operations in the Pacific theater would be relegated to the strategic defensive until such time as victory was assured in Europe and forces could be redeployed to the Pacific.¹⁵¹ By maintaining a strong commitment to political alliances with Britain, France, and Russia, Roosevelt believed the United States would benefit from the alliance's ability to provide the maximum military force to prevail over Germany and ultimately, Japan. If, however, Germany succeeded in knocking both Britain and Russia out of the war in Europe, the United States would be left alone to face the Nazis in Europe and the Japanese in the Pacific. Therefore, the U.S. agreed to address Germany first.

Upon Germany's invasion of Russia in 1941, Britain promised Russia support by initiating a strategic bombing campaign in Germany. Since Britain could not muster sufficient ground troops against the Reich, strategic bombing would at least divert German attention from the eastern front. In this manner, Britain hoped to encourage the

¹⁵⁰ Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank, August 1942 to December 1943* (Chicago: University of Chicago Press, 1949), 277.

¹⁵¹ Craven and Cate, *The Army Air Forces in World War II*, Vol I *Plans and Early Operations*, 137. Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 209-210, 278, 281. Haywood S. Hansell Jr., *The Strategic Air War against Germany and Japan* (Washington, D.C.: Government Printing Office, 1986), 32, 43, 53-54.

Russians' resistance against Hitler.¹⁵² Once the United States was embroiled in the war, Russian pressure increased dramatically for the British and Americans to provide more substantial pressure against the Nazis. As a result, at the January 1943 conference in Casablanca, Roosevelt and Churchill pledged their support for a full air offensive in Western Europe in preparation for an eventual amphibious invasion.

The Economic Context

In 1941 the Army Air Forces outlined the requirements for conducting a full air offensive against Germany in AWPDP-1. This plan was not a capabilities plan to describe what the air force in being could accomplish at that moment. Instead, it outlined the requirements for building aircraft platforms over subsequent years to execute air offensives in each theater. The U.S. aircraft inventory in 1940 was approximately six thousand operational and training aircraft, many of which were obsolete. AWPDP-1 called for a ten-fold increase in platforms over the course of three years and the capability to replace combat aircraft every five months.¹⁵³ Such huge requirements required full mobilization of the U.S. aircraft industry and the highest priority for government investment. To the surprise of many Army and Navy officers, Army Chief of Staff General George Marshall endorsed AWPDP-1.¹⁵⁴ With Marshall's blessing, the Army Air Forces briefed AWPDP-1 requirements to Secretary of War Stimson, and the information was forwarded to the President. In response, Mr. Roosevelt requested the Army Air Force create a full requirements document that would account not only for all U.S. aircraft requirements, but also for all allied aircraft requirements in each theater of operations. The President intended such requirements to be an intrinsic part of the

¹⁵² Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, viii-ix. Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day, January 1943 to May 1945* (Chicago: University of Chicago Press, 1951), 409. Richard J. Overy, *The Air War 1939-1945* (Chelsea, Mich: Scarborough House, 1980), 105. Overy, *Why the Allies Won*, 101-102. Anthony Verrier, *The Bomber Offensive*, (London: B.T. Batsford Ltd., 1968), 83. Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol. 1, *Preparation*, parts 1, 2, 3, in *History of the Second World War*, Publication of the United Kingdom Military Series, ed. J.R.M. Butler (London: Her Majesty's Stationery Office, 1961), 375, 492. Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, in *History of the Second World War*, Publication of the United Kingdom Military Series, ed. J.R.M. Butler (London: Her Majesty's Stationery Office, 1961), 10-11. Gerhard L. Weinberg, *A World at Arms, A Global History of WWII* (New York: Cambridge University Press, 1994), 151.

¹⁵³ Hansell, *The Strategic Air War against Germany and Japan*, 37.

Victory Program, a program that would create a huge pool of weapons for the common service of all nations opposing the Axis powers.¹⁵⁵

The Army Air Forces created AWPD-42 in response to the President's request for all combat aircraft that the United States would have to produce for the AAF and its allies to gain and maintain air supremacy. While the requirements set forth in AWPD-42 met with stiff opposition from both the Navy and other Army programs, they nevertheless were approved by the War Department's General Staff. The President accepted the requirements in October 1942. Mr. Roosevelt thus made aircraft his top production priority for 1943 economic investments.¹⁵⁶

The Military Context

In January 1943 neither the United States nor Britain was prepared to launch an amphibious landing and ground invasion into the teeth of the German Wehrmacht. The Army's War Plans Division concluded that it would require another year to build a merchant marine capable of transporting and supplying the necessary ground forces for such an invasion.¹⁵⁷ Britain, still recovering from Dunkirk, was reluctant to launch an invasion of Western Europe in 1943 and preferred to continue pursuing the indirect approach through operations in the Mediterranean against the Axis flank.¹⁵⁸ Finally, British and American military leaders agreed that it would be necessary to weaken the German army before the Allies could defeat the Wehrmacht on the ground. As a result, the Combined Chiefs of Staff looked to the Army Air Forces and RAF's Bomber Command for an air offensive that would be feasible in 1943.¹⁵⁹ The resulting collaboration between the two air staffs was the Casablanca directive outlining the Combined Bomber Offensive.

¹⁵⁴ Ibid., 40-41.

¹⁵⁵ Craven and Cate, *The Army Air Forces in World War II*, vol 1, *Plans and Early Operations*, 132.

¹⁵⁶ Craven and Cate, Vol 2, *Europe: Torch to Pointblank*, 290-295. Haywood S. Hansell Jr., *The Air Plan that Defeated Hitler*, (Atlanta: Higgins-McArthur, Longino and Porter Inc., 1972) 105.

¹⁵⁷ Hansell, *The Strategic Air War against Germany and Japan*, 33.

¹⁵⁸ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 46-47.

¹⁵⁹ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 210,278. Hansell, *The Strategic Air War against Germany and Japan*, 33. Overy, *The Air War 1939-1945*, 106, 117.

Strategic Options

When the Allies met in Casablanca in January 1943, they made substantial decisions about the course of the war against the Axis powers by outlining their objectives, the assumptions behind those objectives, and the strategies to gain those objectives. As the Combined Chiefs of Staff (CCS) ruminated over Allied objectives, assumptions, and strategies, it was still clear that airpower would play a critical role in operations against Germany. That role was outlined in the form of the Combined Bomber Offensive, or POINTBLANK, directive.

The grand strategic objective set by Roosevelt and Churchill was the unconditional surrender of all Axis countries. In accordance with agreements made at the ABC-1 strategy meetings, military operations would culminate in an invasion of Western Europe to defeat Hitler's military machine.¹⁶⁰ Several underlying assumptions provided the context for the Combined Chiefs of Staff campaign plan. First, the Allies believed their efforts against the Axis powers constituted a total war effort that would require maximum economic and manpower mobilization. The United States and Britain previously set in motion the necessary plans and operations, such as the American Victory Program and extensive air training programs, to support all-embracing war efforts.¹⁶¹ Second, based upon results of the ABC-1 conference and United States War Department's Rainbow plans, Germany would be the first target for offensive operations. With Germany conquered, the Allies would look next to subjugating Japan. Accordingly, the European theater would receive the majority of resources, although opportunities in the Pacific and North Africa theaters created noteworthy diversions of resources and retarded the Allies' ability to concentrate and persist in operations against the Reich until 1944. Finally, the Allies assumed that while airpower would constitute the initial offensive effort against Germany, it would remain a complementary operation in preparation for the amphibious landing and ground invasion against Germany.¹⁶²

¹⁶⁰ Hansell, *The Strategic Air War against Germany and Japan*, 54.

¹⁶¹ Benjamin Franklin Cooling, *Case Studies in the Achievement of Air Superiority* (Washington, D.C.: Government Printing Office, 1994), 273-276.

¹⁶² Overly, *The Air War 1939-1945*, 108. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 10-11.

The Casablanca Directive

The Casablanca directive outlined two objectives for the air effort. Airpower would facilitate the ground invasion of Western Europe by achieving air supremacy over the invasion area as well as Germany proper.¹⁶³ The other objective of the air strategy was to weaken Germany's war-making potential so that Allied ground troops would face a debilitated German Wehrmacht. In articulating these objectives, the Combined Bomber Offensive directive (CCS 166/I/D) adhered to many of the same principles outlined in the American directives, AWPD-1 and 42, as well as the 1941 British-American ABC-1 Agreement.¹⁶⁴ At the Casablanca Conference the airpower strategy outlined a combined effort encompassing both Bomber Command and United States Army Air Force operations. The CBO's mission was:

To conduct a joint United States-British air offensive to accomplish the progressive destruction and dislocation of the German military, industrial, and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened. This is construed as meaning so weakened as to permit initiation of final combined operations on the Continent.¹⁶⁵

The purpose of the CBO was to execute complementary operations between the RAF's night bombing of area targets and the AAF's daylight bombing of precision targets.¹⁶⁶ In fact, it was the complementary aspect of bombing operations that sold Churchill on the POINTBLANK offensive.¹⁶⁷ General Ira Eaker, Commander of the American Eighth Army Air Force, presented the British Prime Minister with several arguments that justified the Americans supplementing British night area bombing with American daytime precision bombing. First, the statistics up until January 1943 indicated that bombing during the daytime was safer than it was at night. Eighth Air Force loss rates were indeed lower than the RAF's at that time. This was because 8th AF limited its

¹⁶³ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 300. Basil Henry Liddell Hart, *History of the Second World War* (New York: G.P. Putnam's Sons, 1970), 599. Overy, *The Air War 1939-1945*, 73.

¹⁶⁴ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 304-305. Hansell, *The Air Plan that Defeated Hitler*, 153. Hansell, *The Strategic Air War against Germany and Japan*, 72. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 12-13.

¹⁶⁵ Verrier, 340.

¹⁶⁶ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 212.

¹⁶⁷ Hansell, *The Air Plan that Defeated Hitler*, 151.

operations to areas within British fighter escort ranges, and German night fighters had greatly improved their tactics against RAF night missions.¹⁶⁸ Second, daylight precision bombing could attack targets that were difficult, if not impossible, to hit at night. As a result, economy of force favored using a smaller precision capability vice a large area bombing package to hit the same target. Eaker also argued that daylight and night bombing complemented each other by placing the Reich under attack a full 24 hours a day, thus constantly stressing enemy air defenses. Finally, daylight bombing would result in destroying German daylight fighters when the Luftwaffe launched fighters to protect German vital centers threatened by the Eighth Air Force.¹⁶⁹ Churchill saw logic in Eaker's arguments and endorsed the philosophy.

The Combined Chiefs of Staff gave the British Chief of Air Staff, Air Chief Marshal Sir Charles Portal, the responsibility for the strategic direction of the CBO and coordination of both RAF and American bomber actions. In reality however, throughout 1943 Bomber Command's commanding officer, Air Marshal Sir Arthur Harris, and General Ira Eaker of Eighth Air Force, had significant operational autonomy. In January 1944, Air Force elements participating in POINTBLANK expanded to include the newly formed 15th Air Force. General Eaker became the commander of 15th Air Force in Italy, while Lieutenant General James Doolittle took over as commander of 8th Air Force in England. Responsibility for both the 8th and 15th Air Forces fell to Lieutenant General Carl Spaatz, commander of the United States Strategic Air Forces in Europe (USSTAF).¹⁷⁰ The fact that operations between the Americans and British were complementary only in a general sense, given the autonomy of British and American commanders, had several ramifications for POINTBLANK's success.¹⁷¹

The POINTBLANK directive, issued 14 May 1943 by the Combined Chiefs of Staff, outlined a two-pronged air strategy to achieve its objectives to paralyze the German war machine. The Americans were to bomb specific target sets during the day including submarine construction yards and bases; aircraft industry; ball bearing, oil, and synthetic

¹⁶⁸ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 216-217.

¹⁶⁹ Ibid., 301-302.

¹⁷⁰ Cooling, 285-286. Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 564. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 82.

rubber factories; and military transport. The particular targets were selected based upon extensive research by a group of British and American analysts. The British were to mount complementary attacks at night upon objectives that were “closely related to the United States bombing effort...which are mutually complementary in undermining a limited number of selective objectives...and where tactical conditions permit, against the cities associated with these targets.”¹⁷² To facilitate such attacks, the CBO identified the intermediate objective of neutralizing the Luftwaffe’s fighter strength to be achieved either simultaneously or prior to further operations.¹⁷³ The relationship between American precision attacks, British area attacks, and Germany’s fighter air defenses, had significant consequences for the manner in which sequential and cumulative air strategies in the CBO interacted.

Sequential Air Strategy in the Combined Bomber Offensive

The sequential portion of CBO air strategy was influenced by three considerations: first, economic and technical decisions the United States made prior to and during the war; second, time constraints driven by operation OVERLORD; and third, operational capabilities and limitations of the British and American air forces.

Economic and Technical Decisions

The first factors that forced a sequential pattern on the Combined Bomber Offensive air strategy were the economic and technological choices President Roosevelt and the Army Air Forces made with regard to force structure. As R. J. Overy noted, “Air forces were compelled to make guesses about how aircraft would be used once war had actually broken out.”¹⁷⁴ Thus, when President Roosevelt formulated the Victory Program and specified AWPD-42 aircraft requirements as first priority for American war production, the Allies took a first step toward an executable sequential air strategy. AWPD-42 specified requirements for heavy bombers in sufficient quantity to allow the USSTAF to

¹⁷¹ Liddell Hart, 599. Overy, *The Air War 1939-1945*, 75. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 4, 83.

¹⁷² Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 306. Verrier, 333.

¹⁷³ Verrier, 331.

¹⁷⁴ Overy, *The Air War 1939-1945*, 17.

prosecute the campaign against Germany. The success of future POINTBLANK operations depended upon the procurement decisions made in 1942. Based on the magnitude of American production and training, as American forces suffered losses in Europe, there were sufficient aircraft and crews to continue the fight. Economic decisions to mobilize at a high level did not completely mitigate the human costs borne by 8th and 15th Air Force during the campaign. For example, minimum mission requirements rose from flying 25 to 30 combat missions. Also, significant losses in the fall of 1943 resulted in a discontinuation of operations until February 1944.¹⁷⁵

In addition to economic decisions, several technical decisions about aircraft characteristics played significant roles in the Allies' sequential air strategy. The importance of adequately managing the technological aspect of airpower early enough to execute a sequential air strategy is illustrated in the development of heavy bombers and long range fighters. An effective bombing strategy depended upon aircraft ranges, bombloads, accuracy and munition effectiveness.¹⁷⁶ Thus, the fact that Britain and America developed heavy bombers with sufficient range to target the depth and breadth of Hitler's Reich facilitated executing the CBO. On the other hand, the Allies faced significant difficulties in executing POINTBLANK until they could provide long-range fighter escorts for heavy bombers. "Although of slight immediate importance to the activities of the Eighth Air Force in the fall of 1942, the concept of U.S. fighter support was fundamental to the notion of a day bomber offensive."¹⁷⁷ Extremely high losses during both the Schweinfurt and Regensburg raids in the fall of 1943 attested to the great need for long-range fighter escort. Although the raids produced significant damage, crew and aircraft losses were unsustainable. The technological challenge of providing long-range fighters was not solved until after Assistant Secretary of War Robert Lovett wrote to General Arnold in June 1943 emphasizing the dire need to address the issue.¹⁷⁸ American and British engineers found that combining the American P-51 Mustang airframe with a British Merlin engine improved the fighter's overall performance and

¹⁷⁵ Mark Wells, *Courage and Air Warfare, The Allied Aircrew Experience in the Second World War* (London: Frank Cass, 1995), 103-104.

¹⁷⁶ Overy, *The Air War*, 17.

¹⁷⁷ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 229-230.

¹⁷⁸ Cooling, 287-288. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 78.

allowed escort missions with a 600 mile radius.¹⁷⁹ The CBO's success depended upon first solving the escort situation and once that was accomplished, subsequent operations in the sequential air strategy could then proceed.

Operation OVERLORD Timelines

If the analyst views the CBO from the perspective of the Combined Chiefs of Staff, sequential aspects come to the fore. Deliberations at Casablanca clearly indicate that being unable to mount a Continental invasion in 1943, the Allies placed the CBO's effects sequentially prior to a ground invasion. Most importantly, the amphibious landing and ground offensive would depend upon Allied air superiority. Just as the Germans attempted to gain air superiority in the Battle of Britain as a precondition for Operation SEA LION, POINTBLANK had to provide the Allies air superiority as a precondition to OVERLORD.¹⁸⁰ Furthermore, the Chiefs ordered the CBO in the expectation that significant effects upon the German economy and warfighting capabilities would aid the subsequent invasion. Beginning the CBO prior to a Continental invasion was not only sequential in time, there was also a logical and causative relationship between the two operations.

Operational Capabilities and Limitations

A third set of factors dictating a sequential air strategy during the CBO was the operational capabilities and limitations of American and British air forces. POINTBLANK strategy was actually executed in several sequential steps. In the first phase during the fall of 1942 and before the CBO officially began, the Eighth Air Force conducted a series of bombing experiments by executing several operations in occupied Western Europe with British fighter escort.¹⁸¹ In this phase the Americans attempted to prove, however erroneous their conclusions were, that strategic bombing operations were possible during the day and under wartime conditions.¹⁸² The fact that the Americans

¹⁷⁹ Liddell Hart, 604. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 79-81.

¹⁸⁰ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 10.

¹⁸¹ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 214-217.

¹⁸² *Ibid.*, 296.

drew their conclusions under circumstances that were quite different from those characterizing operations in 1943 led to unexpectedly high casualties. However, future attrition problems notwithstanding, this phase gave General Eaker the evidence necessary to convince Mr. Churchill to endorse the POINTBLANK strategy.

The second phase of the sequential air strategy, from January 1943 to March 1944, was characterized by lodgment of forces and limited operations at great cost to 8th Air Force and Bomber Command. Their objectives were to gain air superiority and commence bombing operations to weaken Germany's capability and will to wage war. The original CBO plan called for increased bomber strengths over the course of the year; however, competing interests in other theaters and the normal friction of war precluded the Americans from meeting their intended aircraft strengths. Failing to have higher numbers of aircraft earlier in theater handicapped American ability to execute POINTBLANK. From April to July, bomber strength was to have built up to 950 and missions during that time would be limited to targets within British fighter escort range. From July to October 1943, bomber strength was supposed to increase to 1200 and targets would be hit within a 400-mile radius. Attacks were concentrated against aircraft factories, fighter assembly plants, airdromes, aircraft repair facilities, and submarine construction yards. From October 1943 until January 1944, American bomber strength was to increase to 1700, allowing the Americans to attack in force to secure the three CBO objectives: air superiority, weakening German war capabilities, and weakening German will.¹⁸³ Since the intermediate objective was air superiority, these sequential phases were intended to protect heavy bombers first with close fighter escort, then with sufficient concentrated defensive firepower to gain superiority. British warnings that daylight operations would be too hazardous did not dissuade 8th Air Force until the fall of 1943, when skyrocketing losses forced the Americans to reconsider the CBO strategy in terms of its operational capabilities and limitations. The fact of the matter was, bomber strengths did not increase as quickly as anticipated, meaning most bombing packages were limited in their numerical strength. Also, lack of long range fighter escort left the German fighter force free to "take a toll on forces both by day and by night, not only in

terms of combat losses, but more especially in terms of reduced tactical effectiveness.”¹⁸⁴ Eighth Air Force bomber losses escalated to 9.1% of the aircraft credited with attacks and a total bomber loss rate of 26% in October 1943, a month characterized by the second famous assault upon Schweinfurt ball bearing facilities.¹⁸⁵ The Schweinfurt operations indicated that targets deep inside Germany would not yield to independent bomber attack without prohibitive cost. The fact that Luftwaffe front line fighter strength continued to increase greatly frustrated Allied air planners. Allied attempts to preserve bombers by sending friendly fighters in alone would not serve to attrite the German force because the Luftwaffe would not be tempted to engage Allied fighters without the threat of accompanying bombers.¹⁸⁶ However, there was at the same time a bureaucratic loyalty in 8th Air Force’s stubborn adherence to self-defending daylight precision bombers. According to two historians of the CBO:

The tremendous victories of the German fighter force emulated those achieved three years earlier by Fighter Command...A less resolute force would have broken down and a more versatile one would almost inevitably have followed the German and British example of changing to night attack. In the event, the 8th Air Force was cast by a combination of resolution and rigidity into headlong assault on the German fighter force. It was almost involved in tragic defeat.¹⁸⁷

In view of the timelines driven by Operation OVERLORD, 8th Air Force’s failure to gain air superiority over Germany with self-defending bombers in 1943 precipitated a great crisis. The Allies had to avoid the unsustainable losses from the fall to concentrate sufficient airpower on targets that would contribute to gaining air superiority. If the air superiority intermediate objective noted in the POINTBLANK directive was a precondition for OVERLORD, then solving Allied attrition problems was an urgent

¹⁸³ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 370-371. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 16.

¹⁸⁴ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 24.

¹⁸⁵ Cooling, 298. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 74. Williamson Murray, *Strategy for Defeat, The Luftwaffe 1933-1945* (Maxwell AFB, Ala: Air University Press, 1983), 174-175.

¹⁸⁶ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 40.

¹⁸⁷ *Ibid.*, 38-39.

priority.¹⁸⁸ As a necessary sequential step, the air strategy had to gain air superiority through coordinated and sustained attacks upon German aircraft industry and other vital centers in two ways. Bombing operations would damage the Luftwaffe's future growth potential as well as draw the Luftwaffe in being into direct attrition battles.

The criticality of the air superiority intermediate step triggered several events. First, the searching, testing, integrating, and fielding of a long-range fighter capable of escorting bombers to the far reaches of Germany came to fruition as P-51 Mustangs arrived in theater. Adding escort fighters proved significant in targeting the Luftwaffe future capabilities by providing safe passage for bombers targeting German aircraft and related industry centers. As for the Luftwaffe's fighter force in being, Lieutenant Generals Spaatz and Doolittle allowed escort fighters to roam in a free chase to knock out as many Luftwaffe fighters as possible.¹⁸⁹ Post-war assessments note the P-51's latter contribution proved to be quite significant in the gaining of air superiority.¹⁹⁰ Second, major changes in command and organization resulted in more focused effort on gaining air superiority. With the creation of USSTAF and 15th Air Force in January 1944, General Spaatz' strong leadership helped make U.S. and British bombing more cooperative. Spaatz and the RAF's senior leadership believed that if the CBO was to be combined in truth, as it was in spirit, the efforts of Bomber Command had to contribute more directly to 8th Air Force efforts to gain air superiority.¹⁹¹ Orders on 14 and 27 January to Air Marshal Harris from the RAF Chief of Air Staff and his deputy, Air Marshal Bottomley, directed Bomber Command to execute night missions against more relevant targets in the air superiority campaign.¹⁹² Additionally, the CCS's February 1944 release of a change to the POINTBLANK directive is further evidence of attempts to secure Bomber Command's diligent attention to aircraft targets. The February directive updated POINTBLANK guidance by focusing on the air superiority objective, targeting air industry and vital industrial targets, and deleting any reference to area

¹⁸⁸ Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 8, 21, 31.

¹⁸⁹ Cooling, 290, 295. Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 48. Hansell, *The Strategic Air War against Germany and Japan*, 114.

¹⁹⁰ Cooling, 307, 313. Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 58, 62-63. Hansell, *The Air Plan that Defeated Hitler*, 209. Get an USSBS quote here.

¹⁹¹ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 5.

¹⁹² *Ibid.*, 59-69.

bombing for the purpose of targeting German morale or weakening Germany's willingness to fight. Instead, Bomber Command's efforts were to be more focused upon winning the air superiority intermediate objective.¹⁹³ In keeping with CCS direction, on 25 February 1944 Bomber Command attacked Schweinfurt in conjunction with 8th Air Force daylight raids. These coordinated operations might be considered the first true instance of a combined effort in the bombing offensive.¹⁹⁴ The February Schweinfurt attacks were part of a series of operations codenamed ARGUMENT. ARGUMENT, subsequently called BIG WEEK by many airmen, was a series of escorted massive raids upon the German aircraft industry with emphasis on fighter facilities.¹⁹⁵ The combined efforts of 8th and 15th Air Force and Bomber Command dealt a fatal blow to the German fighter force and allowed the CBO to move to the next step.¹⁹⁶ After complete force buildup and achieving air superiority, AWPD-42 originally called for a full six months of bombing against the industrial targets that formed the backbone of German war-fighting capabilities.¹⁹⁷ However, the exigencies of time necessitated that CBO targeting transition, at least for a time, from vital centers to objectives that would immediately contribute to OVERLORD's success.

The direct use of airpower in support of OVERLORD characterized the third phase of the CBO as it was executed. Instead of targeting German war-making industry for long-term effects, this phase in the CBO sequential air strategy directly facilitated the amphibious landings and breakout of American and British ground units across the Atlantic wall beachhead. Airpower concentrated against airfields within striking distance of Allied ground troops, rail bridges, marshaling yards, maintenance facilities, and limited efforts against some oil targets.¹⁹⁸ Because the CBO's focus was on the ground battlefield situation, General Eisenhower assumed operational control of Bomber Command and USSTAF (both 8th and 15th Air Forces) from the end of March until mid-

¹⁹³ Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 27-28. Hansell, *The Air Plan that Defeated Hitler*, 177-178. Hansell, *The Strategic Air War against Germany and Japan*, 96-97. Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 83-84.

¹⁹⁴ Cooling, 280. Liddell Hart, 602.

¹⁹⁵ Cooling, 285. Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, xii, 13, 30.

¹⁹⁶ Weinberg, 663.

¹⁹⁷ Hansell, *The Strategic Air War against Germany and Japan*, 118.

¹⁹⁸ *Ibid.*, 104-107.

September 1944. Heated debate raged among air leaders concerning which target set strategic bombers should most appropriately concentrate upon in support of OVERLORD. Eisenhower directed the bulk of bombing missions against transportation targets. Although Spaatz preferred to focus on oil targets, per Eisenhower's direction strategic forces predominantly bombed transportation targets to deny Germany the ability to concentrate and reinforce its ground troops.¹⁹⁹ Allied ground troops successfully landed and began ground offensive operations against the Wehrmacht. The fact that the landings on 6 June could be accomplished without enemy air attacks was a testament to the success of the air superiority efforts previously taken.²⁰⁰ Air operations against transportation nets foiled German attempts to check the Allied thrust on the ground. Eisenhower also used strategic bomber forces to attack German V-1 missile facilities to mitigate the terror bombings Hitler commenced in a desperate attempt to force Britain out of the war.

Phase four of POINTBLANK began in September 1944 and continued through the end of the war in Europe. Eisenhower relinquished command of the strategic air forces back to Chief of Air Staff Chief Air Marshal Portal, General Spaatz, and Air Marshal Sir Arthur Harris.²⁰¹ This last phase of POINTBLANK returned to the airmen's original conception of concentrating on industrial targets to weaken the capability and will of Germany to continue to wage war. Since Allied air superiority was virtually uncontested, Bomber Command also joined USSTAF in daylight bombing efforts.²⁰² The majority of bombing targets were POINTBLANK-enumerated target sets with special emphasis on oil facilities and transportation networks to inhibit further German military operations.

Summarizing Sequential Air Strategy in the Combined Bomber Offensive

The sequential air strategy underlying the CBO reflected a functional dependence of the series of steps of the strategy up until Germany's surrender. First, the Allies had to create a properly configured and sufficiently sized force structure to execute bombing operations. Critical economic and technical decisions made immediately prior to the U.S.

¹⁹⁹ Weinberg, 679.

²⁰⁰ Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 58, 160.

²⁰¹ Ibid., xiv.

²⁰² Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, 286.

entrance to the war and in the first two years of open conflict meant USSTAF and Bomber Command had the numbers and types of bomber aircraft to execute POINTBLANK. As a result of the long-range bombers' inability to defend themselves against a robust air defense capability, fully prosecuting operations against vital centers was impossible until the Allies solved the technical problem of long-range fighter escort. Second, the CBO needed adequate political backing from the CCS to make it an integral part of the Allied theater campaign plan. Operations in 1942, before the CBO officially began, were necessary to convince Churchill to back the day and night bombing strategy. Next, the CBO air strategy had to gain air superiority. While the Allies hoped this step might be secured coincident with debilitating attacks upon the Germans' capabilities and will to continue fighting, ultimately gaining air superiority was a necessary intermediate objective to continue future operations. Facilitating Allied ground troops landing and initial ground offensive in Western Europe was the next step in the air strategy. General Eisenhower exercised his prerogative to direct strategic air forces efforts towards facilitating ground operations. The CBO, having secured air superiority and initial success for the ground war, finally was free to concentrate on amassing maximum destruction upon the German war-making potential. With the exception of the final phase of the CBO, which did not necessarily depend upon OVERLORD's success, each of these steps in the air strategy hinged on the success of the previous steps.

Cumulative Air Strategy in the Combined Bomber Offensive

While the Combined Bomber Offensive contained identifiable steps of a sequential air strategy, cumulative logic nevertheless played an important role in the CBO. First, the logic of a cumulative air strategy was evident inside each step of the sequential air strategy. Second, the effects of one stage in the sequential air strategy did not disappear with the beginning of the next phase. Instead, airmen hoped that the accumulating effects from all air operations would contribute to the air objectives. Third, the cumulative effect of the attacks on oil and transportation targets from the spring of 1944 to the end of the war produced the increasing debilitation of German industry, which materially aided the ground advances of both the western Allied and Soviet armies. While the Combined Chiefs of Staff and General Eisenhower were very conscious of the sequential aspects of

CBO air strategy, both the US Army Air Force and RAF Bomber Command's approaches to the CBO were primarily based upon the cumulative air strategy within and between the phases. In fact, one school of thought among airmen held that the cumulative air strategy, based upon the combined effects of independent bombing operations, might have rendered the ground invasion unnecessary altogether.

Cumulative Air Strategy inside Sequential Steps

If the POINTBLANK air offensive had a relatively identifiable sequential air strategy revolving around four phases, within each of these phases, air operations are best characterized as cumulative. The intended target set concentration within each phase changed slightly in accordance with the overall sequential logic, but operations proceeded one day at a time with each sortie's bombing effects contributing to the weight of the total effort. The POINTBLANK mission statement was particularly well suited to executing a cumulative campaign because the objectives were served by escalating pressure resulting from independent operations. By directing an offensive to "accomplish the progressive destruction of the German military, industrial, and economic system and the undermining of morale," the strategy depended upon independent destructive acts combining to provide the desired effect.²⁰³ The fact that the Committee of Operations Analysts delineated six target systems with no particular order of importance strongly suggests an underlying cumulative logic for the air strategy. Even when operational considerations made gaining air superiority a necessary sequential step, if that logical layer is peeled apart, the core of that phase was also cumulative, being characterized by a series of independent bombing operations. The USSTAF and RAF targeted aircraft production plants, engine plants, and remaining targets on the CBO target set list that would provoke the Luftwaffe fighters to take to the air where they would be destroyed. There was no particular order of those operations, nor did the success of one sortie depend upon the success of the previous.

²⁰³ Verrier, 330.

Concentration: A Cumulative Imperative

While Generals Spaatz and Eaker as well as Air Marshal Sir Arthur Harris attempted from the outset to pursue a cumulative air campaign within each phase, they differed in their opinions about the targets for that campaign. As a result, there was difficulty in the cumulative aspect of the strategy in maintaining concentration and persistence against the targets that would be most lucrative in accomplishing the air campaign's objectives. Consistent with Wylie's observed characteristic of a cumulative strategy, measuring the strategy's progress or success was difficult. This difficulty gave rise to considerable argument concerning the efficacy of bombing different target systems. As the official history noted, because "the effects of the bombing were gradual, cumulative, and during the course of the campaign rarely measurable with any degree of assurance, there was little visible progress."²⁰⁴ The difficulty faced by the Committee of Operations Analysts (COA) and joint British-American intelligence teams to assess the CBO's efficacy is a direct reflection of the complexity in identifying lucrative targets and measuring success of a cumulative air strategy. Also, analysts encountered problems in post-war bombing studies attempting to pinpoint evidence of the effects of a cumulative air strategy. It was that much more challenging for war participants to anticipate the targets and effects at the time they were formulating a cumulative air strategy. This conundrum was not unique. Carl von Clausewitz discussed the difficult but necessary exercise of attributing causes and effects in warfare.²⁰⁵ Clausewitz acknowledged that since confusion, friction, and chaos characterized warfare, it would be difficult to ascribe cause and effect even for phenomena observed firsthand. The air strategist in the CBO faced a problem that much more complex in predicting and assessing the causes and effects of air operations he would not directly observe or measure.

This tension between prediction, observation, cause, and effect, resulted in differences of opinion regarding the efficacy of certain targets in the CBO cumulative air strategy. The CBO directive did not clear up any confusion because it addressed several objectives and target systems. While the directive was intended to promote

²⁰⁴ Craven and Cate, *The Army Air Forces in World War II*, Vol 2, *Europe: Torch to Pointblank*, ix.

²⁰⁵ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 156-157.

complementary operations, it instead resulted in competing operations that in many ways lacked concentration. American airmen believed more precise attacks against war-making industries would be most efficient in subverting German war capabilities. Sir Arthur Harris insisted that dehousing German workers and targeting German morale more readily accomplished the CBO objective, and thus chose urban area targets such as the Ruhr, Hamburg, and Berlin. As the timeline to OVERLORD shortened, there was tremendous pressure to concentrate CBO operations on gaining air superiority and pre-invasion preparation of the battlefield. Harris clung to the theory that area bombing would be decisive and continued to execute his bomber sorties against cities despite direction to the contrary. Air Chief Marshal Sir Charles Portal and his deputy, Air Marshal Bottomley, sent several letters to Harris directing him to abandon general area attacks and coordinate his raids with 8th Air Force efforts so as to achieve better concentration.²⁰⁶ The Combined Chiefs of Staff issued several interim directives with orders to concentrate efforts against certain target sets, for example, aircraft production, transportation, and oil.²⁰⁷ Directives notwithstanding, tactical considerations and doctrinal stubbornness drove a dispersion of efforts as Harris continued with general area bombing. Harris's arguments were that night bombing accuracy precluded him from hitting precise targets. Even with the improvements of radio and radar bombing aids *Gee*, *Oboe*, and *H2S*, Harris believed these aids would simply allow him to avoid German fighters and concentrate on area bombing.²⁰⁸ Throughout POINTBLANK, there was an unresolved tension between Spaatz's and Harris's approach to the cumulative air strategy. Not all British leaders felt as strongly as Harris did, however. Sir Charles Portal observed, "Thus, while area bombing, if it could have been continued long enough and in sufficient weight, might in the end have forced the enemy to capitulate, his countermeasures would have prevented us from maintaining such a policy to the decisive point. We would have been forced to precision attack to maintain the air situation needed

²⁰⁶ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 35-36, 59-69.

²⁰⁷ Liddell Hart, 609.

²⁰⁸ Webster and Frankland, *The Strategic Air Offensive Against Germany, 1939-1945*, vol 2, part 4, *Endeavor*, 26. Weinberg, 775.

to continue the offensive at all.”²⁰⁹ Even though the Americans and several British officers disagreed with Harris, the cumulative nature of the CBO proceeded throughout on dual tracks with the Americans pursuing precision attack and Harris general area bombing. The effect of the cumulative air strategy “was not a single, spectacular victory, but a slow and lethal erosion of fighting capability.”²¹⁰ Despite philosophical difficulties underlying the cumulative air strategy, under the general onslaught, Germany’s ability to withstand the bombing and continue to protect itself from the Allied ground offensive gradually broke down.

Cumulative Air Strategies and Attrition

The success of a cumulative air strategy within each phase of the CBO depended upon Allied ability to outlast the Luftwaffe by maximizing the quantity of aircraft and aircrew produced and minimizing losses to the same. Luftwaffe fighter production and strength increased each year, despite POINTBLANK bombing efforts. (Appendices 8 and 9) That fact notwithstanding, the number of aircraft and crew available to the Luftwaffe were no match for overwhelming Allied numbers. (Appendices 10 and 11) The Allies out-produced Germany consistently, which led to significantly greater air strength as seen in Appendix 8.²¹¹

Being better equipped, the Allies were therefore able to recover from aircraft and aircrew attrition losses more easily than the Germans. The Luftwaffe simply could not recover given high levels of attrition suffered at the hands of Allied fighters. As POINTBLANK attacks increased in 1943 and 1944, the Germans entered into a negative spiral of declining effectiveness. The Luftwaffe was forced to bring as many aircrew as possible from other fronts and training units to the Reich for fighter defense to defend what the Germans had to consider as a fourth front.²¹² (Appendix 12) German airmen had to defend the Reich itself in addition to the French, Russian, and Italian fronts.²¹³ Qualitatively, time and fuel constraints limited the number of hours pilots received in

²⁰⁹ Sir Charles Portal letter to Sir Arthur Harris 8 Jan 1945, quoted in Tony Mason, *Airpower: A Centennial Appraisal* (Washington, D.C.: Brassey’s, 1994), 58.

²¹⁰ Overy, *Why the Allies Won*, 130.

²¹¹ Overy, *The Air War 1939-1945*, 76-78, 183-184.

²¹² Davis, 515. Speer, 278. Weinberg, 420.

²¹³ Murray, 181.

training. Limited training hours meant pilots were less experienced than their Allied counterparts, whose average exposure to training hours were increasing each year. The result was that greater numbers of inexperienced German aircrew faced more experienced Allied pilots who were capable of knocking out German pilots more quickly, in turn placing more stress on the German training pipeline to turn out pilots quickly. Even though German production rose in 1944, the number of front line fighters did not substantially increase because of loss rates and crew availability.²¹⁴ (Appendix 13 and 14) The increasing German attrition rates clearly indicated the success of the cumulative strategy. The Allies were able to sustain operations, while the Luftwaffe simply did not have the forces to hold out.

Post-OVERLORD Cumulative Strategy

A major portion of the cumulative aspect of Allied air strategy took place during CBO operations from the fall of 1944 until the spring of 1945. During this period British and American airmen targeted oil, transportation, and aircraft industries, ultimately bringing the German war economy to a virtual halt and facilitating the advances of Western Allied and Soviet ground troops. Much of the Allied success during this period was due to the fact that by mid-September 1944 operational U.S. airframes in the European theater actually exceeded the numbers called for by AWPDP-1. Where AWPDP-1 required 2,992 heavy bombers and 2,080 fighter aircraft, by fall 1944, USSTAF had 4,980 heavy bombers and 4,969 fighters. Against these aircraft the Germans could counter with only 293 medium bombers and 999 fighters.²¹⁵ The impressive numbers were testament to the strength of Allied cumulative air strategy. Month by month, Allied production churned out more aircraft for delivery to the theater. At the same time, Allied airpower destroyed increasing numbers of German aircraft in the air, on the ground, and in the factories.

After OVERLORD the Combined Chiefs of Staff issued several directives ordering attacks to concentrate on oil and transportation targets. Attacks on synthetic oil plants actually began in mid-May 1944 but were severely curtailed by operations in preparation

²¹⁴ Craven and Cate, *The Army Air Forces in World War II*, vol 3, *Europe: Argument to VE Day*, 62. Murray, 303. Overy, *The Air War 1939-1945*, 81. Weinberg, 617.

²¹⁵ Davis, 528.

for the Normandy invasion. Attacks against synthetic oil plants and transportation networks affected the whole German war effort including air force operations and training and Wehrmacht ground movements on all fronts.²¹⁶ For example, the Luftwaffe's consumption of aviation gasoline was less than one-third what it had been in early 1942.²¹⁷ Also, during the Battle of the Bulge the Germans were forced to abandon tanks and trucks on the battlefield for lack of fuel.²¹⁸ Appendix 15 shows the cumulative effects of the air attacks German synthetic oil production.

The other major target, the transportation system, included freight marshaling yards, railways, and waterways. One of the results of targeting transportation was the strangulation of German coal production. Hard coal production was reduced from 23,169,000 metric tons in June 1944 to 6,983,000 metric tons in February 1945.²¹⁹ Inland waterway coal movements were reduced from 3,131,000 metric tons to 422,000 metric tons between July and December 1944.²²⁰ Reichsbahn freight car availability was also severely reduced, which further degraded coal production. In February 1945 there were 1,069,322 cars as opposed to 4,007,934 cars in June 1944.²²¹ In Table 2 the shortfalls of coal distribution reflect how the cumulative strategy affected the coal industry.

²¹⁶ Richard Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, D.C.: Government Printing Office, 1993), ix. Weinberg, 774-775.

²¹⁷ Mets, 258.

²¹⁸ Mets, 265. Speer, 416-417.

²¹⁹ Alfred C. Mierzejewski, *The Collapse of the German War Economy, 1944-1945*. (University of North Carolina Press, 1988), 189.

²²⁰ Mierzejewski, 193.

²²¹ Mierzejewski, 191.

Table 2. Estimated Hard Coal Deficit Caused by Shipping Difficulties

		Reichsbahn		Inland Waterways		Total Cumulative
		Shortfall	Cumulative	Shortfall	Cumulative	
1944	Aug	1.7	1.7	No Data	No Data	1.7
	Sept	4.8	6.5	.25	.25	6.8
	Oct	5.7	12.2	.89	1.1	13.3
	Nov	5.9	18.2	.96	2.1	20.3
	Dec	5.6	23.8	.73	2.8	26.6
1945	Jan	8.7	32.5	1.2	3.9	36.5

Source: Alfred Mierzejewski, *The Collapse of the German War Economy, 1944-1945* (University of North Carolina, 1988), 194.

Without coal, German industry could not fuel its armament production. Effects from these attacks resulted in severely reducing deliveries of raw materials and finished products to and from German factories. Parts and finished products were stranded at factories unable to be moved to the front line at the very moment American, British, and Russian ground troops were forcing the Wehrmacht to consume their local supplies voraciously.²²² Appendix 16 shows the effect coal and railroad industry strangulation had upon armament production in the Reich. The synergy between ground offensives at the front and cumulative effects of the CBO in the rear combined to Allied advantage.

Summarizing Cumulative Air Strategy in the Combined Bomber Offensive

A cumulative logic underlay Allied air strategy during the Combined Bomber Offensive. The effects of independent air operations combined to place tremendous pressure upon both the German economy and military forces. The cumulative aspects of Allied air strategy were not, however, without tension. The difficulty in measuring precise effects of the strategy led to British and American air leaders having divergent opinions about the most efficacious targets. This resulted in a lack of concentration on any one target set . . .perhaps to the detriment of the strategy, in the minds of many

²²² Davis, 507.

airmen who subscribed to the theory that sufficient concentration upon a single target might constitute the knock out blow against Germany. Ultimately, the combination of the increasing effects from striking several well-chosen target groups showed how the cumulative aspect of Allied air strategy contributed significantly to ultimate victory.

Interactions between Sequential and Cumulative Air Strategies in the Combined Bomber Offensive

The original CBO directive suggested that Allied strategic air forces would pursue two types of air strategies, one sequential and one cumulative. In this construct, the sequential air strategy facilitated the cumulative. The sequential air strategy began with economic and technological decisions about force structure that could provide sufficient numbers and kinds of aircraft platforms to execute the cumulative air strategy. Next, gaining the political backing to pursue a cumulative air strategy was necessary to proceed. In another sequential step in the air strategy, rising losses in 1943 forced both RAF and American air leaders to recognize the need to concentrate on gaining air superiority before OVERLORD could proceed. At this juncture, the effects of a purely cumulative air strategy were difficult to measure and were thought not to be decisive. Thus, the Combined Chiefs of Staff concluded that providing sufficient air support for OVERLORD was a necessary step in the sequential air strategy. Finally, day and night bombing operations in the cumulative air strategy aimed at breaking Germany's capability and will to fight also depended upon first gaining air superiority.

The cumulative strategy also facilitated the success of the sequential air strategy. By executing individual operations, the effects within a given phase gained momentum in breaking the German's capability to wage war. The cumulative air campaign depended upon concentrating individual operations on the correct target sets, for example the aircraft industry targets, to gain the intermediate Allied objective of air superiority. Also, the Allies were able to build air strength over time while dissipating German air strength and economic strength. As a result of early CBO operations, OVERLORD and follow on ground operations faced a debilitated Wehrmacht. Later CBO efforts from the fall of 1944 to March 1945 saw overwhelming numbers of Allied airplanes conducting systematic attacks on oil and transportation targets that eventually brought the Germans

war economy to its knees. These same air attacks continued to aid British, American, and Russian ground troops in their march to the German heartland. Victory against Germany in the west was thus partially the result of mutually reinforcing sequential and cumulative air strategies.

Chapter 5

Sequential and Cumulative Air Strategies in the Southwest Pacific Area

The first-line strength of [Japan's] naval air units had been sacrificed in the Solomons and on New Britain, and the first-line strength of its army air units had fallen a victim...at Wewak and elsewhere on New Guinea. One of the decisive victories of the war had been won. It was a victory primarily for land based air power, and other victories which followed, among them the conclusive one, undoubtedly came easier because of it.

— Wesley Craven and James Cate, *The Army Air Forces in World War II*

It is the capacity to return day after day to the same targets, to tear up again and again the same runways, and to keep an unbroken watch against the reinforcement of threatening enemy air bases that permits an air organization to perform its primary function by winning and keeping control of the air.

—Wesley Craven and James Cate, *The Army Air Forces in World War II*

In studying the broader political and military contexts of World War II, strategists can appreciate the roles sequential and cumulative air strategies played in the Southwest Pacific Area (SWPA) campaign's success. Given the tensions between competing resource requirements in the European and Pacific Theaters, Allied success in the Pacific depended upon a strategy that could concentrate sufficient force against Japan's most vulnerable garrisons. The tension between concentration of force and economy of force dictated the nature and tempo of air operations in the Southwest Pacific Area. A combination of sequential and cumulative airpower strategies was influenced by--and in turn supported--attaining Southwest Pacific Area theater and national level war objectives.

Political, Economic, and Military Contexts

The Political Context

Although Allied objectives included the complete military defeat and surrender of Japan, priorities in World War II focused on a Germany-first strategy that called for predominant levels of manpower and equipment to be invested in the European theater.²²³ Additionally, aside from agreeing upon the general objective of Japan's surrender, the Pacific theater was complicated by differing political agendas among the Allied powers. Britain, China, Australia, and the United States each pursued diverging political interests that "forestalled any agreement on strategy and fostered a command system of bewildering complexity."²²⁴ However, in agreement with the British and in deference to its preponderance of force, the Americans acted as the lead agent for strategy in the Pacific theater. American plans were based upon its pre-war Plan Orange and Rainbow Five. War Plan Orange was admittedly more a statement of hope than a realistic plan for operations in the Pacific.²²⁵ While the United States intended to protect its interests in the theater, in reality the resources assigned to the Pacific by Rainbow Five dictated a defensive strategy until such time as sufficient manpower, equipment, and supplies were available for an offensive campaign.²²⁶ Thus, America committed itself to a long-term effort; its Pacific strategy took into account considerations beyond the immediate conditions when hostilities commenced in 1941.²²⁷ Where Japan hoped its immediate victories would allow it to present a *fait accompli* to the Allies and negotiate victory, the

²²³ Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, vol 4, *The Pacific: Guadalcanal to Saipan. August 1942 to July 1944* (Chicago: University of Chicago Press, 1950), x, 131. Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, vol 5, *The Pacific: Matterhorn to Nagasaki. June 1944 to August 1945* (Chicago: University of Chicago Press, 1953), 735. Edward S. Miller, *War Plan Orange: The U.S. Strategy to Defeat Japan, 1897-1945* (Annapolis, Md: Naval Institute Press, 1991), 314-315. Louis Morton, *United States Army in World War II. The War in the Pacific, Strategy and Command: The First Two Years* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1962), 80. Gerhard L. Weinberg, *A World at Arms, A Global History of WWII* (New York: Cambridge University Press, 1994), 311.

²²⁴ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, vii.

²²⁵ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars* (Maxwell AFB, Ala: Air University Press, 1987), 50. Miller, 322, 332.

²²⁶ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 56. Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 735. Morton, 30. Richard J. Overly, *The Air War 1939-1945* (Chelsea, Mich: Scarborough House, 1980) 88.

²²⁷ Miller, 321.

Allies considered Japanese aggression as simply the first move in a longer game the Allies fully intended to win.²²⁸

A Germany-first philosophy notwithstanding, throughout the course of World War II there was tremendous tension in sorting out the Army and Army Air Force requirements between the European and Pacific theaters.²²⁹ Military events in 1942 precipitated a slight shift in political priorities that allowed the Allies to pursue a more aggressive strategy in the Pacific than planners originally imagined. In the European theater, Churchill convinced Roosevelt that a full fledged invasion of western Europe was not possible in 1942.²³⁰ Additionally, Allied victories in May and June of 1942 at the Battles of the Coral Sea and Midway encouraged the Americans to press their advantages in the Pacific. Still, even after these two resounding naval victories, Generals Marshall and Arnold would not support sending more than a limited amount of resources to the Pacific. They instead prevailed upon theater commanders, General Douglas MacArthur and Admiral Chester Nimitz, to allocate properly the forces they had available. The overarching Allied political strategy was to place steadily mounting pressure upon the Japanese from all quarters, but to do so employing a limited level of manpower and equipment.²³¹

The Economic Context

The Allies depended upon robust American economic strength to underpin a long-term strategy--overwhelming Japanese forces in the Pacific with equipment and manpower of superior quality and quantity. When the American war machine began to spin up, Japanese economic production had not peaked. Quick Japanese victories in 1941 and early 1942 lulled Japan's leaders into believing what they hoped to be true: that the war would be short. As a result, the Japanese delayed full economic mobilization. In 1941, Japan invested approximately 8 percent of its total national product in war materials. Because of the political climate, the United States in 1941 employed a far

²²⁸ Overy, *The Air War*, 86. Weinberg, 310

²²⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 20.

²³⁰ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 44.

²³¹ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 61. Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 131, 194, 549.

smaller percentage of its economy for war material production.²³² In both cases, economic mobilization proceeded steadily throughout the war. The Japanese yearly index value of production in terms of 1945 prices for all military supplies for their war economy increased tremendously:

Table 3 Production Value Index for Military Supplies in Japan

1941	1942	1943	1944	1945
100	131	215	309	200

Source: Military Supplies Division, *The United States Strategic Bombing Survey, Japanese War Production Industries*, USSBS Reports Pacific War No. 43, 1946, 5.

However, despite high levels of economic mobilization, Japan waged war at an extreme disadvantage. Even at its peak level of mobilization in 1944, in comparison with the United States, Japan produced war materials at only 10 percent of the potential capacity of the U.S. economy.²³³

In the short term, Allied strategy depended upon reinforcing and supplying the Pacific to deny further Japanese expansion. In the longer term, American factories and mobilization efforts were to provide fast aircraft carriers, aircraft, submarines, munitions, combat support equipment, and manpower to overwhelm Japanese forces. A vast economic base allowed the United States to underwrite such a plan. In contrast, economic mobilization delays adversely affected Japan's ability to reinforce its outer defense perimeter. When attrited in battles at Midway, the Coral and Bismarck Seas, the Solomons, and New Guinea, the Japanese found they could not rebuild forces again to maintain their offensive war effort or reinforce their defensive perimeter.²³⁴ In the case of aircraft, where the Japanese began 1941 with a larger number and sufficient quality of aircraft (mostly Zeros), by the end of the war, Allied aircraft numbers and quality of

²³² Military Supplies Division, *The United States Strategic Bombing Survey, Japanese War Production Industries*, USSBS Reports Pacific War No. 43, 1946, 5.

²³³ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 78-79. Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 740. Military Supplies Division, USSBS Reports Pacific War No. 43, 1946, 6.

²³⁴ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 740.

design far outstripped Japanese capabilities.²³⁵ Once hostilities began, Japan shifted its war production emphasis to aircraft and anti-aircraft industries to compensate for attrition suffered at the hands of the Allies. As a percentage of total war industry production, by 1943 and through the end of the war, Japan dedicated the most investment to air and anti-air equipment, but economic realities meant U.S. production capacity overwhelmed the Japanese.

Table 4 Japan's Relative Shares of Yearly War Production

	1941	1942	1943	1944	1945
Air	32.2	39.0	46.8	48.3	51.9
Ground	28.9	20.5	12.4	8.2	7.6
Naval	38.9	40.5	40.8	43.5	40.5

Source: Military Supplies Division, *The United States Strategic Bombing Survey, Japanese War Production Industries*, USSBS Reports Pacific War No. 43, 1946, 6.

By far the most limiting factor in the Japanese economy was its lack of natural resources.²³⁶ Although Japan learned to optimize consumption of critically needed oil, steel, coal, rubber, ferro-alloys and non-ferrous metals, its dependence upon outside sources and merchant marine transshipment constituted an increasing vulnerability.²³⁷ The Allies, in contrast, had significant resource bases that were out of range from Japan's offensive striking forces. The difference between Japanese and Allied capacities for the economic support necessary to underwrite their war efforts was an important factor in Allied strategy prevailing over Japanese strategy.

The Military Context

In the early part of World War II, the SWPA suffered doubly from pre-war military stagnation as well as a result of taking a back seat to European theater operations. As previously noted, War Plan Orange identified insufficient resources available for

²³⁵ Overy, *The Air War*, 94.

²³⁶ Military Supplies Division, USSBS Reports Pacific War No. 43, 1.

²³⁷ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 78.

defending theater objectives. Knowing that there were not sufficient forces in theater to prevail in the case of attack, the United States had forward deployed B-17 bombers in the Philippines as a deterrent to Japanese aggression and a signal that the Allies would defend their interests.²³⁸ Not only did the Allies present Japan with a limited deterrent force, theater commanders began hostilities with insufficient spare parts, small numbers of equipment, inappropriate tactics, and poor training.²³⁹ This state of affairs in the Pacific derived from America's general state of unpreparedness for war and the strategic calculation that national interests in Europe were more pressing than those in the Pacific. Until Japanese aggression at Pearl Harbor roused American ire, the Allies were politically unable and unwilling to mobilize sufficient forces in the theater to do anything more than support a defend-reinforce-buildup-attack strategy.²⁴⁰

Within a few months of Pearl Harbor, the Japanese consolidated an impressive number of victories, conquering the Netherlands East Indies for much coveted natural resources and annihilating forward deployed American ground and air forces in the Philippine Islands. The Japanese outer perimeter reached from the North Pacific Kuriles and outer Aleutians to Wake Island and the mandated islands in the Central Pacific, the Solomons, New Guinea, and Netherlands East Indies in the South Pacific, and finally Singapore, Burma, and occupied China.²⁴¹

Geography fundamentally affected military operations in the SWPA. Initially the Japanese enjoyed interior lines of communication that facilitated replacements and supply of its forward garrisons.²⁴² Also, with their impressive victories Japan threatened Australia proper as well as the sea lines of communication (SLOC) between Australia and the United States. To help protect those SLOCs, the U.S. created a ladder of island airfields to provide air lines of communication (ALOC) as well as protection for SLOCs.²⁴³ However, in comparison to the Japanese, the Allies had tremendously long and vulnerable supply lines. The complexity of moving men and equipment from the

²³⁸ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 50.

²³⁹ Thomas E. Griffith Jr., *MacArthur's Airman: George C. Kenney and the War in the Southwest Pacific* (Lawrence, Kansas: University Press of Kansas, 1998), 232.

²⁴⁰ Miller, 3.

²⁴¹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, vi, 3.

²⁴² Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xi.

²⁴³ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, vi, 27.

United States to the theater meant that the proportion of assets en route was very high. Equipment that leaders in Washington D.C. believed to be already in use was frequently in transit and unusable for theater operations. Nevertheless, the nature of geography in the Pacific theater meant all combatants had to contend with the logistics of deploying, supporting, and reinforcing isolated garrisons. Availability of shipping and air transport thus constituted a major advantage.

Pacific geography fundamentally affected the nature of military operations in other ways as well. Pacific warfare was island warfare, placing a premium on the mobility of forces over vast distances. In the SWPA military strategy depended heavily upon joint operations and dictated important roles for both naval and air forces.²⁴⁴ Topography of the islands did not facilitate the use of heavy armored units for the most part. Ground operations frequently entailed small units in close combat with the enemy in jungle and sometimes mountainous terrain. As a result, provision of close air support was significantly more difficult than the Allies experienced in Europe, the Mediterranean, or North Africa.²⁴⁵

Military operations in the SWPA required extensive development of facilities. Unlike Europe's matured industrial base, islands in the SWPA did not possess robust infrastructure; therefore, the Allies had to bring the infrastructure to the theater.²⁴⁶ In the case of air operations, strategy in the SWPA depended in large part upon the Allies ability to build airstrips and airdromes, maintain equipment, and provide medical care, messing, and billeting. In many cases, advanced bases and airdromes were primitive.

Given the distances and nature of leadership personalities in the Pacific Theater, command and control relationships were complicated and fragmented. Unlike Europe, where there was a pronounced effort to streamline command and control, in the Pacific Theater there were two co-equal commanders. The Central Pacific, by virtue of its heavy dependence upon naval power, was commanded by Admiral Nimitz. South of an imaginary line dividing the theater in two, General MacArthur commanded the Southwest Pacific Area. SWPA included the Philippines, Netherlands East Indies, New Guinea, the Admiralties and the Solomons. MacArthur's area was further complicated by another

²⁴⁴ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 736.

²⁴⁵ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xiii-xiv.

boundary at 159th east meridian separating South Pacific from Southwest Pacific operations. Integrating airpower in the theater was problematic given the fragmented command and control arrangements; however, the SWPA was blessed with a fairly harmonious relationship between MacArthur and his ranking airman for most of the war, General George Kenney.²⁴⁷ Beginning in April 1943, in theater command and control was further complicated by leadership provided directly from Washington D.C. for certain B-29 very long-range bomber missions against the Japanese home islands.²⁴⁸ Thus, military strategy was marked by frequent debate between Army and Navy, and intra-theater cooperation substituted for a unified command structure.²⁴⁹ The map at Appendix 17 shows the two theaters. Militarily, in 1941 the Allies faced daunting challenges in the SWPA: an enemy with the preliminary advantage in position; forces of fewer numbers and equipment of lesser quality; extremely long lines of communication; difficult close terrain; rudimentary support facilities, and complicated command and control structures.

Strategic Options

The Allies based SWPA strategy upon several assumptions. First, they assumed the Pacific war would be a total war waged over a long period of time. Based upon the Arcadia Conference in late 1941, the Allies assumed the early loss of Guam and the Philippine Islands and adopted a defensive posture to limit the extent of the Japanese advance. Originally there would be limited means in both equipment and manpower because of the Europe first strategy; however, in time the U.S. would be able to pour sufficient resources in theater to prevail, provided the defense could hold in the interim. A second assumption the Allies made was that geography in the Pacific theater would require unprecedented coordination between operations in all three mediums: land, sea, and air. Finally, in the Pacific theater, the force of events was not easily foreseeable; therefore, the Allies needed to pursue a strategy with several different options that would provide flexibility for future decisions.

²⁴⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xii.

²⁴⁷ Griffith, 231-232.

²⁴⁸ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, xiv-xvi, 39-41.

²⁴⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xii.

In keeping with the grand strategic objective in the Pacific Theater to force unconditional surrender of the Japanese, the Allies strategy pursued several strategic tracks. First, the effort would depend heavily upon U.S. allies in theater to defend against and place maximum pressure upon the Japanese. This included resistance from the British in the Burma/India/Indian Ocean area as well as Chinese forces in Burma and in China itself. Later in the war, the U.S. encouraged Russia to attack Japan from the north. Second, using America's vast economic advantage, the strategy was to build up a large fast carrier fleet as well as numerous air platforms (both fighters and long range bombers) for several purposes. Top priority would be to keep the lines of communication open between the U.S. forward-deployed forces, and Australia. Also, forces would be used to acquire suitable bases from which the Allies could project power (including strategic bombing) at the Japanese mainland. Fleet and air assets would re-supply all Allied forces in theater including British and Chinese. Most importantly, the Allies would use the interdependence of land/sea/air operations to attrite Japanese forces in such a way that Japan might unconditionally surrender once the Allies reached Japan proper. The third aspect of Allied strategy was a blockade of the Japanese home islands using both naval (surface and subsurface) and air assets to deny them war-making material and weaken the economic base from which Japan prosecuted the war. Finally, if necessary the Allies recognized the possibility that an invasion of the Japanese homeland might be necessary to gain military capitulation and unconditional surrender.²⁵⁰

The two American service arms, Army and Navy, each had its preferred approach toward the overall Pacific strategy. The Army preferred moving from New Guinea and the Solomons up through the Philippine Islands and Formosa to strike Japan. Navy leadership favored a more direct path to Japan using islands in the Central Pacific ocean area. Because there was not a single theater commander, Pacific Theater operations followed elements of each approach. The Allies banked that the combination of approaches would provide them the best opportunity to conclude the Pacific war. Not knowing which strategy would be most successful, they pursued each with the intent that they could defeat Japan with whichever approach or combination of approaches could be

²⁵⁰ Kent Roberts Greenfield, *American Strategy in World War II, A Reconsideration* (Malabar, Fla: Krieger Publishing Company, 1963), 8. Griffith, 5. Miller, 3-5. Overy, *The Air War*, 90,95. Weinberg, 311.

implemented most effectively. Ultimately, the President dictated the final stages of Pacific Theater strategy. The Allies were fortunate that they had sufficient war materiel to underwrite these multiple strategic approaches.

Various Courses of Action

In 1941 and virtually throughout the duration of the war, there was no comprehensive strategy palatable to both the Army and Navy.²⁵¹ The Pacific theater's broader strategy identified three approaches, each of which the Allies pursued simultaneously. Even within the constraints of a Germany first grand strategy, U.S. economic strength provided sufficient resources to implement each course of action and continue concentrating force directly on the Japanese defensive perimeter. Each alternative contributed to the final victory in the Pacific Theater. Although Japan controlled a large amount of territory as of January 1943, in reality its defensive perimeter rested upon relatively small numbers of forces deployed in a series of island outposts. If the U.S. could concentrate power against the more vulnerable outposts; bypass and isolate those that were too strong to attack directly; and deny Japan the ability to reinforce their positions; the Allies could move ever closer to the Japanese home islands.²⁵²

The Army advocated two strategies. MacArthur's first choice strategy was to move from island to island through the Southwest Pacific directly to the Philippine Islands and then project force upon the Japanese main islands from the Philippines. Secondarily, the Army (and the Army Air Force in particular) advocated gaining bases in Burma, India, and forward locations in China from which a strategic bombing campaign against mainland Japan might be pursued.²⁵³ This course of action became very difficult because of the problems associated with transporting the tonnage of supplies required to support the forward bases. The shortage of suitable labor and engineers to build airfields also complicated this option. Nevertheless, it was an AAF favorite because of the primary role strategic bombing would play in the campaign.²⁵⁴ American airmen were anxious to

²⁵¹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 19.

²⁵² Griffith, 235.

²⁵³ Overy, *The Air War*, 96.

²⁵⁴ Overy, *The Air War*, 97.

demonstrate that bombing Japan without a D-Day type landing would be sufficient to prevail. Ultimately, this option would take longer to execute than a more direct route through the Pacific Islands and it was eventually abandoned.

The Navy advocated pursuing an “island hopping” campaign through the Central Pacific islands including Saipan, Iwo Jima, and Okinawa, from which an Allied Normandy-like invasion could be mounted.²⁵⁵ The Navy argued this route would be the fastest and therefore most efficient. Portions of this plan also appealed to Army Air Force leadership since the Marianas islands could provide airfields from which they could launch B-29 strategic bombing attacks.²⁵⁶

All three courses of action depended heavily upon airpower. Carrier and land-based airpower was necessary for air superiority and freedom of movement on both sea and land; defending the flanks, lines of communications, and outer edges of the offensive; interdicting Japanese assets and supplies; providing vital reconnaissance; inserting resupply; airlifting troops; and finally, bombing both close support and strategic targets.²⁵⁷ “Assaults were never to gain land masses or to capture populous cities, but only to establish airfields and fleet anchorages and bases from which the next forward spring might be launched.”²⁵⁸

Ultimately, the Allies used a combination of the three courses of action to implement their strategy against Japan. MacArthur went to the Philippines, the Navy and Marines island-hopped through the Central Pacific as far as Okinawa, and the Army Air Forces bombed Japan mainland with B-29 long-range bombers. Effects from the blockade and bombing of the Japanese economy; attrition of Japanese forces; and devastation of Japanese cities eventually convinced the Japanese Emperor to surrender.

Sequential Air Strategy in the Southwest Pacific Area

As Commander of the SWPA, General MacArthur intended to support the Pacific strategy by positioning himself to strike Japan directly from the Philippines. The overall Pacific strategy was to isolate Japan, attrite Japanese forces along its outer perimeter,

²⁵⁵ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 134.

²⁵⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 555. Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, xiv.

²⁵⁷ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xiv. Griffith, 74. Overy, *The Air War*, 101

move U.S. forces increasingly to within direct striking distance of the homeland, and strike the homeland directly with strategic bombing and if necessary, an invasion. To address the immediate Japanese threat to Australia and Allied lines of communication between Australia and the U.S., the Joint Chiefs of Staff approved a three-task plan for operations in the Southwest Pacific Area (SWPA) and South Pacific. Task one directed occupation of the lower Solomon Islands by South Pacific forces under the command of Vice Admiral Robert Ghormley, supplemented with the help of SWPA land-based airpower. Task two entailed SWPA forces consolidating forces from Port Moresby, New Guinea, and reoccupying New Guinea's northeastern coast and the northern Solomons. Task three called for SWPA to neutralize New Britain, specifically attending to the Japanese stronghold at Rabaul.²⁵⁹ By neutralizing the threat to his right flank, General MacArthur could move from New Guinea to the Philippines—and closer to the home islands. The air strategy that facilitated moving from the outer edges of New Guinea to the Philippines was, at the strategic level, sequential in nature because it necessarily had to succeed before the Allies could strike Japan's home islands directly.

The success of the strategic bombardment campaign which ended so dramatically at Hiroshima and Nagasaki was rooted in the two years of bitter fighting by air, naval, and ground forces which had carried the Allies from Guadalcanal and Port Moresby to Guam and Sansapor. It was the campaigns of those years which had blunted the enemy's air weapon and had provided the bases within bomber radius of Honshu.²⁶⁰

An examination of the air strategy at the operational level reveals two sub-levels of sequential air operations. At the strategic-operational interface, the Allies clearly employed sequential operations to move northward culminating with the liberation of Luzon, Philippine Islands. Appendix 18 sketches the advance on a map. Within the Southwest Pacific Area, there were two lines of advance that facilitated moving north towards the Philippines. Beginning with protecting the small outpost of Allied resistance at Port Moresby and establishing a foothold by amphibious landings at Guadalcanal, the Allies employed a sequential air strategy to support advances along the northern coast of New Guinea and up the Solomon Islands chain. Failure of the air strategy at a particular

²⁵⁸ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, xvii.

²⁵⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 19-21.

²⁶⁰ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, v.

step meant the advance would stall. Both General Kenney of 5th Air Force and the Commander Air Forces South Pacific (COMAIRSOPAC) provided air operations to facilitate the dual advances. Sequential operations making up the ELKTON plan called for MacArthur's SWPA command to move in steps up the coast of New Guinea, establishing airfields and projection force ever northward.²⁶¹ At the same time, Vice Admiral Ghormley (later Admiral Halsey) Commander of South Pacific forces, and General Harmon, Commanding General U.S. Army Force in South Pacific, began at Guadalcanal and pursued a line of operations northward through the Solomon Islands. Each avenue of the advance was intended to position the Allies to neutralize the Japanese outpost at Rabaul, New Britain and allow the Allies to continue north to the Philippines. Appendix 19 shows the locations of the operations along the route of advance.

Air operations at the operational-tactical interface were also sequential. A pattern of air operations was repeated with each Allied move northward that secured the next objective. First, land based air forces would conduct reconnaissance and establish local air superiority with airstrikes at Japanese airbases within range of the objective.²⁶² For example, in the case of Guadalcanal and Buna operations, Allied ground troops seized Dobodura and reoccupied Goodenough Island to construct airfields. From Port Moresby, Dobodura, and Goodenough Island the Allies launched offensive counter air strike missions against Japanese airfields at Rabaul, Buka, Kieta, Munda, Buin, Buna, Lea, and other Solomons airfields in enemy hands.²⁶³ In the case of the amphibious landing at Lae and Finschhafen, aircraft conducted strikes to neutralize Japanese airdromes at Hopoi, Lae, Wewak, Gasmata, Madang, and Cape Gloucester.²⁶⁴ In the case of June amphibious landing operations, both MacArthur's efforts at Kiriwina and Woodlark Islands and Halsey's seizure of Rendova benefited from air strike missions targeting the northern Solomons, New Ireland, and eastern New Britain.²⁶⁵ In the first of several sequential steps moving up the New Guinea and Solomon chain, the air forces lacked enough strength to mount air assaults day and night with any persistence.²⁶⁶ Nevertheless, the

²⁶¹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 129.

²⁶² Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 55.

²⁶³ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 111-113.

²⁶⁴ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 183, 188.

²⁶⁵ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 221.

²⁶⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 161.

philosophy was established, and gaining “control of the air situation” was job one.²⁶⁷ As the SWPA forces gained in air strength and experience, their ability to conduct pre-invasion air strikes to secure air superiority improved. By the time MacArthur’s troops landed in Luzon, Philippines, Allied air attacks at Clark, Nichols, and Nielson airfields rendered “Japanese air services on Luzon...almost [completely paralyzed] even before the landings.”²⁶⁸

Once air strikes secured the necessary air superiority over the immediate objective, air forces would execute a pre-invasion bombardment to soften amphibious landing or ground objective areas as well as interdiction operations. After Allied forces had successfully entrenched themselves and were in contact with the enemy, the air forces executed interdiction missions to deny the enemy reinforcement and resupply. For example, in the case of Guadalcanal, air forces denied Japanese reinforcements from Truk.²⁶⁹ In another instance, 5th Air Force secured a key victory in aerial interdiction of Japanese reinforcements for Lae coming from Rabaul. In the Battle of the Bismarck Sea, several Japanese naval transports were destroyed or turned back resulting in a significant setback in Japanese efforts to hold New Guinea.²⁷⁰ Intelligence intercepts gained through ULTRA proved critical in vectoring airpower to interdiction targets on this and many other occasions.²⁷¹ Airpower’s ability to deny enemy reinforcement at Lae was an indication of the pattern interdiction air operations would take during the entire SWPA campaign.²⁷² At Cape Gloucester, intensive pre-invasion bombing destroyed enemy resistance so that ground opposition was minimal. Thereafter, the 5th Air Force called pre-invasion bombing and interdiction attacks “Gloucesterizing.”²⁷³ Maintaining air cover over landing objectives and SLOCs supporting engaged enemy forces was critical throughout the campaign. If interdiction was weak, it was due to one of three reasons. First, initial tactics and munitions proved ineffective and until innovation occurred in both arenas, early interdiction effects were limited. Poor weather proved to be a continuing problem; however, not even General MacArthur could influence the weather.

²⁶⁷ Griffith, 233.

²⁶⁸ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 411.

²⁶⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 57.

²⁷⁰ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 146.

²⁷¹ Griffith, 245.

²⁷² Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 150.

Finally, the fact that there were so few fighter aircraft platforms and that fighter crews were continually in a state of semi-exhaustion from unrelenting mission tempo, meant the operational effectiveness of the interdiction effort was marginal.²⁷⁴ The fact that the Allies had such a difficult time in securing Leyte was in part due to the early failure of aerial interdiction operations. Without significant land-based airpower assets to cover Leyte, the Japanese were able to reinforce and resupply their forces at will. “Within two weeks after A-day, the Japanese had landed some 22,000 reinforcements at Leyte.”²⁷⁵ Until land based airpower could successfully deny Japan’s reinforcements of the battle area, wherever it was, the Allied ability to prevail on the ground was problematic. However, prevailing on the ground was a necessary precondition for the construction of airfields from which land based airpower would then be used to project power to the next objective.

After supplying reconnaissance, securing air superiority, protecting the initial landings of ground troops, and isolating the battlefield, Allied air operations centered around providing air transport to furnish resupply and reinforcements and close support for ground troops engaged in battle. For example, in the case of Australian ground troops at Wau and Kokoda, air transport was critical to sustain their attacks. The terrain in SWPA frequently denied over land resupply/reinforcements; therefore, the only way some ground troops were able to maintain contact with the enemy was through aerial resupply and reinforcement.²⁷⁶ During the landings at Nassau Bay, Allied ground troops were almost completely supplied with food and munitions by air transport.²⁷⁷ Keeping ground troops resupplied and reinforced was necessary to clear out Japanese from the ground objective area and construct forward airfields, thus facilitating the entire sequence of operations to repeat again for the next targeted objective. At Nadzab living conditions remained primitive while the mission continued because all supplies were provided by air transport for the first several months of operations. Air transport was key in moving airpower forward because that transport carried fighter platforms (P-47 and P-38), construction equipment, ground crews and infantry for airstrip protection. All this was to

²⁷³ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 345.

²⁷⁴ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 223, 262.

²⁷⁵ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 376-377.

²⁷⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 108, 136.

provide aircover for future amphibious landings.²⁷⁸ These sequential air operations thus depended upon providing successful air transport service operations.

The case of close air support (CAS) for ground forces was more complicated in the SWPA than other theaters by virtue of the terrain involved. CAS operations were complicated by difficulties with command and control, communication connectivity, and target identification. Despite heroic efforts and increasing success levels, checkered CAS records in many of the objective areas, for example, the Buna/Wau operations in New Guinea, reflected that CAS missions were the most difficult step in the sequential air strategy.²⁷⁹ During operations at New Georgia, “it quickly became apparent that consistent close support of ground troops from the air, as originally planned, was impracticable. The jungle simply did not permit it.”²⁸⁰ At Leyte, because reconnaissance, air superiority, interdiction, and supply missions required such an extensive level of air resources, few air platforms remained to execute CAS missions.²⁸¹ A Sixth Army report noted the importance of CAS at Leyte where, “operations brought out very strongly, although in a negative way, the vital relationship of air power to the success of the offensive as measured by the period of time required to complete the utter destruction of the hostile force.”²⁸² In many situations, CAS was critical for ground units to secure terrain at the objective area. Near Manila, V Fighter Command executed the largest employment of napalm in the Pacific war when it saturated Japanese positions at Ipo and forced Japanese ground troops to abandon their protection for open ground, making them easy for Allied ground attack. Although SWPA ground and air components struggled to implement productive CAS, direct air support of ground troops was still a necessary sequential step providing ground troops security to construct airbases for the next operational leap forward.

The sequence of air operations: reconnaissance, air superiority, aerial bombardment and interdiction, air transport, and close air support was repeated at each objective area as

²⁷⁷ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 167.

²⁷⁸ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 177, 186.

²⁷⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 123.

²⁸⁰ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 231.

²⁸¹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 384.

²⁸² Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 385.

Allied forces moved north toward Japan.²⁸³ An important merging of forces occurred at the conclusion of plan ELKTON. Upon securing the Solomon Islands and New Guinea, Admiral Halsey dissolved the South Pacific Air Forces and portions of them merged with MacArthur's Southwest Pacific Area Air Forces under General Kenney's leadership. The Joint Chiefs of Staff combined 13th Air Force with 5th Air Force and approved the creation of Far East Air Forces (FEAF).²⁸⁴ FEAF continued the same pattern of air operations as they executed a sequential air strategy to support objectives in the Philippines.

Operational Capabilities and Limitations

Two technical advances facilitated executing the sequential air strategy that brought Allied forces ever closer to the Japanese home islands. Without these innovations, the operational effectiveness of airpower in the SWPA would have been far inferior and General Kenney's and COMAIRSOPAC's ability to successfully gain air superiority and isolate the battlefield through interdiction may have been fatally compromised. The first advance was in adding drop tanks to fighter aircraft to extend their range. The limited fighter aircraft radius was a major factor in determining the rate of advance of SWPA operations.²⁸⁵ To gain air superiority it was necessary to strike Japanese airfields that could send bombers over Allied objective areas. Unfortunately, while American bombers had the range to reach such airfields, fighter escorts could not accompany the bombers at the outer boundaries of bomber ranges. For example, over early New Guinea and Guadalcanal operations, it was necessary to persistently target Rabaul and Bougainville area airfields with bomber missions. However, SWPA lacked fighters with the appropriate range to escort B-17 bombers to Rabaul and operations over Bougainville were less than ideal given the P-38's disadvantage flying at B-26 altitudes.²⁸⁶ Also, when MacArthur's New Guinea operations designated Hollandia as the next location for Allied advance, it was outside of fighter range. The addition of drop tanks to the P-38J extended its radius to 650 miles and helped provide fighter coverage of the landings there.²⁸⁷

²⁸³ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 211.

²⁸⁴ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 571.

²⁸⁵ Morton, 587.

²⁸⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 85, 174.

²⁸⁷ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 587.

A second innovation was in modifying munitions and low level bombing tactics to improve interdiction, especially anti-shipping, missions. Early statistics for strikes against shipping targets were lamentable because the normal AAF high level bombing doctrine was not effective against maneuvering surface ships. In November 1942, B-17 heavy bomber anti-shipping operations logged only one percent successful hits. Therefore, SWPA airmen retrained to bomb at mast height with newly fuzed bombs. Kenney's service command outfitted B-25's with extra guns and fragmentation bombs. Attack planes (A-20's) were outfitted with fragmentation bombs attached to a parachute and an instantaneous fuze.²⁸⁸ The combination of new tactics and aircraft with more effective munitions helped SWPA airmen improve interdiction missions against airfields, merchant shipping, and troop sea transports. The tremendous success at the Battle of Bismarck Sea in March 1943 attested to the fact that these modifications made interdiction missions effective. When the Japanese resorted to night operations because daylight missions were too dangerous, Allies employed the newly developed SCR-717B Sea Search Radar, SCR-729 interrogator-responder, and improved altimeters, radar scopes and bomb-release mechanisms to facilitate blind bombing at night.²⁸⁹ This equipment was succeeded by the SB-24 low-altitude radar bombardment platforms. Per plane, these aircraft sank or damaged more surface craft at night from low altitudes than heavy bombers did by daylight missions.²⁹⁰ In combination, technological innovations improved the operational effectiveness of SWPA aircraft and made possible the execution of a sequential air strategy.

Summarizing Sequential Air Strategy in the Southwest Pacific Area

The Allies intended to bring war home to the Japanese home islands as quickly as possible to force Japan's surrender. Given the distances in the Pacific theater and Japan's early successes in establishing an extended defensive perimeter, the Allies could not immediately strike directly at the home islands. In the interim, a sequential air strategy facilitated a series of Allied successes beginning at the outermost reaches of the Japanese defensive perimeter and moving ever inward. MacArthur's advance would ultimately

²⁸⁸ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 63-67, 106.

²⁸⁹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 197.

²⁹⁰ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 241-242.

provide bases from which the Allies could execute concentrated anti-shipping interdiction, large-scale air attacks against the Japanese home islands, and prepare for a ground invasion of Japan.²⁹¹ By first gaining local air superiority and providing for the protection of ground troops, who would in turn construct forward airfields, each battle success built the foundation for the next leap forward. By progressing in steps supportable by the range of land and carrier based air power, the Allies could moved against the enemy—continuing to make inroads toward the ultimate locus of Japanese power in the home islands. The danger of moving too quickly toward Japan without first providing continuous air superiority, interdiction to isolate the battlefield, and aircover for amphibious landings was illustrated in places such as Leyte where Allied losses were heavy and the ground troops' ability to prevail was tenuous given the lack of persistent aircover.

Within each battle there was a sequence of interdependent air operations. Adequate reconnaissance preceded all air operations and provided necessary information about enemy dispositions. Air superiority strikes facilitated successful interdiction to isolate the battlefield. Air superiority and interdiction facilitated air operations to provide coverage for amphibious landings with pre-assault bombing and continuous air screens over landings. Successful close air support of landed troops was in turn interdependent upon the troops landing safely and air interdiction denying as many enemy reinforcement as possible. Air resupply and reinforcement could not be successful until after air superiority, interdiction, pre-assault bombing, and troop landings and protection were secured.²⁹² Most importantly, the sequential air strategy brought Allied forces close enough to make possible direct assaults upon Japan proper. There were thus two sequential aspects of Allied air operations in the SWPA. First, as a whole, they formed the core around which MacArthur built his theater strategy of incremental advance from the southern tip of New Guinea to Luzon. Second, within the operations conducted against each geographic objective, there was a discernible sequence of sub-operations that when combined together, projected Allied power ever closer to Japan.

²⁹¹ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 62.

²⁹² Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, xi.

Cumulative Air Strategy in the Southwest Pacific Area

Cumulative air strategy is characterized by a relative independence among air operations. Moreover, the individual effect of the operation contains a certain value that is, in effect, banked away. When the value executing a number of independent air operations reaches a certain level, the air strategist can use their cumulative effects to further his goals. In this manner the SWPA air strategy also demonstrated cumulative aspects.

Cumulative Air Strategy inside Sequential Steps

In the SWPA, air planners intended for specific categories of air operations to be executed in a certain predictable order in order to project Allied power ever closer to the Japanese home islands. If at the strategic and operational levels of war there was a sequential air strategy, that did not preclude those same air planners from leveraging cumulative aspects of the air strategy at the same time. The sequential air strategy shaped air operations at the operational level with a generally predictable pattern of operations:

- 11 Reconnaissance
- 12 Air Superiority
- 13 Air Interdiction
- 14 Air Transport
- 15 Close Air Support

Within these sequential steps however, there was a cumulative phenomenon. At the tactical level, individual air sorties may have been successful or unsuccessful with their execution independent of each other. For example, to gain control of the air prior to moving into Buna and Guadalcanal, the Allies flew several air superiority operations against Japanese airfields. Operations against airfields in Rabaul, Buin, and Munda were executed to pin down Japanese air so that Allied operations could proceed without enemy air harassment. While the totality of the sorties' effects was to provide air superiority, the individual raids did not depend upon each other for their success. At the tactical level, the success of B-17s targeting New Britain airfields really had no bearing upon success of other B-17s on their way to Bougainville for the same purpose. The logic is equivalently applied to air interdiction missions of shipping targets for the purpose of denying the Japanese reinforcement and resupply. For example, at Buna the Japanese were able to

land reinforcements regularly through November 1942, bringing their ground strength up to approximately 9,000.²⁹³ Individual interdiction missions during the fall were unsuccessful many times. After November, there was evidence that individual interdiction missions met with improved success. On later missions in November 1942, the Allies were able to deny completely two Japanese attempts to reinforce troops. Two other missions saw mixed results with three hundred of eight hundred Japanese soldiers killed and in another attempt while men got ashore, they landed minus valuable equipment.²⁹⁴ Therefore, at the tactical level individual air missions for interdiction purposes both succeeded and failed; however, their individual results were not dependent upon each other. Instead, separate effects from different sorties combined to bear upon the battlefield situation at the operational level. Some Japanese landings were successful, some interdiction missions were successful; however, the total Japanese ground strength at Buna and the ability of Allied ground troops to prevail over that Japanese ground strength depended upon the accumulated results of these independent missions at the operational level. For example, as the Allies built up air strength in theater they were able to apply persistent air attacks against target airfields that helped secure air superiority and facilitated isolating Allied landing objectives. During the invasion of Hollandia in New Guinea, among several airfield targets, the Allies targeted Japanese airstrips at Wewak. Beginning 11 March 1944 until 25 March, Fifth Air Force coordinated heavy, medium, and light bomber missions to maintain constant pressure against the Japanese garrison. While the airstrips were easily repaired overnight, the cumulative effect of persistent air attacks prompted the Japanese General at Wewak to abandon the location. General Teramoto moved his headquarters rearward to Hollandia and abandoned his ground troops to retreat by any means available.²⁹⁵

At the operational level, there was a certain independence of missions that suggests the air strategy contained cumulative aspects. The fact that the Japanese were completely denied reinforcement at Lae because of the positive results of aerial interdiction during the Battle of Bismarck Sea greatly facilitated the Allies ability to prevail at the Huon Peninsula on New Guinea. That success notwithstanding, at Leyte air interdiction to

²⁹³ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 122.

²⁹⁴ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 122.

deny the Japanese reinforcements was ineffective in the initial stages, allowing the Japanese to land 22,000 troops to fight at Leyte after the first Allied landings.²⁹⁶ Previously successful air interdiction at Lae did not necessarily bear upon the Allies' ability to interdict on other occasions in the sequence of operations. Similarly, the Allied ability to provide close air support missions at Corregidor did not depend upon the success of individual CAS missions at Papua, New Guinea or New Georgia in the Central Solomon Islands. CAS missions at Buna and New Georgia met with only limited success given the jungle terrain involved.²⁹⁷ At Corregidor, however, successful CAS missions allowed the Army to prevail over Japanese troops who were prepared to fight desperately and exact as great a toll as possible from Allied ground strength.²⁹⁸

Cumulative Air Strategies and Attrition

If an individual mission's result did not necessarily depend upon the success of previous missions, the total effect of all the air operations did influence the campaign at the operational and strategic levels. The fact of the matter was the Japanese could not recover from the attrition of pilots and aircraft platforms they suffered in the early campaigns of 1942 and 1943.²⁹⁹ (See Appendix 20 for Japanese losses during the different campaigns in the Pacific.) As the Allies bested the Japanese in the Solomons and New Guinea, the Japanese threw their aircrews piecemeal into battle and the most experienced airmen were lost over places like the Battle of the Coral Sea, the Battle of the Bismarck Sea, Guadalcanal, Buna, Bougainville, Hollandia, and the Cape of Gloucester.³⁰⁰ At Hollandia in particular, the victory "was destined to have long-term effect on the remaining period of the war."³⁰¹ Japan's entire Sixth Air Division was destroyed and inactivated.

Despite Japan's ability to continue to produce aircraft platforms in the home islands, the quality of pilot training programs declined precipitously. As a result of declining

²⁹⁵ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 589.

²⁹⁶ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 377.

²⁹⁷ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 123-126, 231-232..

²⁹⁸ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 433-434..

²⁹⁹ Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 60. Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 740. Center for

³⁰⁰ Center for Aerospace Doctrine, Research and Education, *The United States Strategic Bombing Surveys, European and Pacific Wars*, 62.

training, by the end of the war the flying experience of the average Japanese pilot was around one hundred hours—in comparison to the average American pilot who received about six hundred hours of training.³⁰² Appendix 21 shows the drastic decline of Japanese pilot experience as the war progressed. The shortage of aviation fuel provides other evidence that the Japanese Air Forces were deteriorating at an increasing rate. As the air war progressed, the Japanese had to reduce their aviation fuel consumption at an increasing rate. Curtailing pilot training because of the shortage of aviation fuel was another reason Japanese pilots entered combat with less experience than their American counterparts.³⁰³

In addition to a shortage of pilots, Japanese air operations suffered from poor serviceability.³⁰⁴ Japanese maintenance personnel forces suffered from the same attrition phenomena as Japanese pilots. In 1945 Japan conscripted workers from aircraft factories and withdrew trainees from flying training in a desperate attempt to increase the number of maintenance personnel. As their numbers dwindled, maintenance personnel could not maintain or disperse their aircraft because of ground crew and facility limitations.³⁰⁵

The total effect of air attrition upon Japanese aircrew was that there simply were not enough pilots or maintenance personnel to meet all requirements. One prisoner of war noted that at Hollandia the numbers of planes far exceeded trained pilots.³⁰⁶ With continuing losses, a devastating pattern evolved for the Japanese. As the Americans attrited Japanese aircraft and aircrew in battle, the Japanese had to curtail aircraft and aircrew development to put forces prematurely into the field. Once committed to battle, those forces were not as well prepared as their American counterparts and they were eliminated that much more quickly.³⁰⁷ Appendix 22 shows the increasing attrition rates suffered by the Japanese. The cumulative effect of mounting losses after each encounter with the Americans meant the Japanese could never recover the initiative they held in

³⁰¹ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 598.

³⁰² Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, 740.

³⁰³ Military Analysis Division, *The United States Strategic Bombing Survey, Japanese Air Power*, USSBS Reports Pacific War No. 62, 1946, 41-43.

³⁰⁴ Military Analysis Division, USSBS Reports Pacific War No. 62, 33-34.

³⁰⁵ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 598. Military Analysis Division, USSBS Reports Pacific War No. 62, 14.

³⁰⁶ Craven and Cate, vol 4, *The Pacific: Guadalcanal to Saipan*, 598.

³⁰⁷ Craven and Cate, vol 5, *The Pacific: Matterhorn to Nagasaki*, xx. Military Analysis Division, USSBS Reports Pacific War No. 62, 2.

December 1941 through mid-1942.³⁰⁸ Evidence of the Japanese inability to bring their airpower to bear upon the battles in the SWPA is their extensive use of Kamikaze tactics beginning with Leyte operations. Kamikaze sacrifices accomplished what inexperienced Japanese aircrew could not: damaging the Allied superior naval, air, and ground forces before being neutralized.

In comparison with the United States, Japan's economic base could not accommodate the levels of attrition suffered during operations in the Pacific theater. In 1941, Japan's aircraft industry produced approximately five thousand planes. The Japanese training programs provided approximately three thousand pilots. After Japan mobilized in 1943, their aircraft production and aircrew training capacities did not increase substantially in comparison to American statistics. Japanese aircraft production increased to 16,700 platforms and pilot training rose to 5,400 pilots in 1943. However, the United States was able to out-produce Japan significantly in both aircraft and pilots. In 1941 the U.S. provided nineteen thousand aircraft and eleven thousand pilots. Compared to the Japanese, American mobilization increased tremendously as aircraft and pilot production soared to 85,000 planes and 82,000 pilots in 1943.³⁰⁹ The Japanese short war mentality and ill advised complacency over their original successes precluded them from appreciating the increasing air attrition effects upon their war operations—effects resulting from the cumulative aspects of Allied air strategy.

In comparison with Japan, the Allies were able to increase the number and quality of aircraft and aircrew in the Pacific theater and thus take advantage of the cumulative aspect of their air strategy. By increasing the number of aircraft and crew, the number of individual sorties increased and the accumulated effects from each of these sorties increased. Appendices 23 and 24 show a comparison of first line combat aircraft and men available from January 1943 until the end of the war. The Japanese attrition trend sharply contrasts with the United States' increasing numbers in theater. The numbers of aircraft and aircrew available for both the U.S. and Japan reflect the results of executing a cumulative air strategy. The United States leveraged the individual effects of

³⁰⁸ Military Analysis Division, USSBS Reports Pacific War No. 62, 30.

³⁰⁹ Military Analysis Division, USSBS Reports Pacific War No. 62, 2.

independent air operations to its advantage. Japan suffered the consequences in a negative attrition spiral.

Cumulative Air Strategy and Anti-Shipping Operations

Another cumulative aspect of the air strategy in the SWPA was the air attacks on Japanese merchant shipping to weaken Japan's war economy. The purpose of such attacks was to impede Japan's ability to prosecute the war and its ability to resist Allied landings on the home islands, should those landings be necessary. In the SWPA, countershipping attacks were executed between 1942 and November 1943 almost exclusively as a part of military and naval operations in the Solomons, New Guinea, and Philippines.³¹⁰ After liberating the Philippines, SWPA land based aircraft were free to prosecute anti-shipping more aggressively, especially because aircraft were now within range of Japan's major shipping routes. Under General Kenney, the newly constituted Far East Air Forces (FEAF) attacked shipping routes in the South China Sea until Japan was forced to abandon them. FEAF land based aircraft also were able to target shipping in the Yellow Sea, Korean Straits, and areas around the Japanese island of Kyushu. In total, the FEAF directed approximately 18% of its air operations against shipping targets.³¹¹

By 1945 Allied counter shipping efforts completely denied Japan its overseas shipping routes and fundamentally impaired coastal movements.³¹² The FEAF's anti-shipping operations contributed to Allied successes in this arena. United States Strategic Bombing Survey analysis indicates aircraft sunk approximately 33% of Japanese shipping and played a significant and indispensable role in denying Japan its trade lifelines. In fact, the operations around the Philippines and Marianas islands made those locales the most concentrated areas for Japanese ship casualties in the war.³¹³ Thus, other benefits of the cumulative aspect of SWPA air strategy were the independent and accumulating effects of countershipping air operations.

³¹⁰ Overall Economic Effects Division, *The United States Strategic Bombing Survey, The Effects of Strategic Bombing on Japan's War Economy*, USSBS Reports Pacific War No. 53, 1946, 36.

³¹¹ Overall Economic Effects Division, USSBS Reports Pacific War No. 53, 39.

³¹² Overall Economic Effects Division, USSBS Reports Pacific War No. 53, 41.

³¹³ Overall Economic Effects Division, USSBS Reports Pacific War No. 53, 43.

Summarizing Cumulative Air Strategy in the Southwest Pacific Area

The SWPA air strategy was cumulative in several respects. First, individual air sorties that together constituted the logical core of steps in the sequential air strategy followed a cumulative logic. Individual sorties' effects were, in a sense, banked together to present the Japanese with an operational reality. The operational realities included such effects as successful local air superiority or interdiction to isolate an Allied objective. Against Japanese air forces the Allies were able to exact cumulative effects from their air strategy by attriting Japan's aircraft platforms and aircrew in early operations—attrition from which Japan could not recover despite its extensive economic mobilization in 1943. Finally, the air strategy against Japanese shipping was cumulative in nature in that individual and independent anti-shipping operations denied Japan critical merchant shipping tonnage.

Interactions between Sequential and Cumulative Air Strategies in the Southwest Pacific Area

In the case of the SWPA campaign, the air strategist can discern a complicated set of relations between sequential and cumulative air strategies that created the conditions to promote victory. One possible interaction is for a sequential air strategy to facilitate executing a cumulative strategy. This scenario applies to the SWPA in relation to the overall Pacific strategy. At the strategic level, the sequential air strategy implementing ELKTON was a causal precursor to the cumulative air strategy later associated with anti-shipping operations. Once SWPA aircraft were within range of Japan's principal shipping routes, they could conduct strikes against merchant vessels. One-third of the shipping tonnage sunk was attributed to air strikes, of which the FEAF contributed significant effort.

There was also a nesting of sequential air strategies. While the air strategy at the strategic level was sequential because reaching within striking distance of Japan was a necessary step before direct strikes could begin, getting to within that radius also entailed a sequential air strategy at the operational level. MacArthur's progression from Port Moresby, New Guinea to Lingayen's beaches on Luzon depended upon a sequential air strategy that secured each Allied objective before moving northward to the next. The air

strategist can clearly identify the series of objectives won with a sequential air strategy at Table 3. Also at the operational level, a second layer of sequential air strategies secured the individual objectives in the sequential campaign. For example, SWPA air forces executed a sequential air strategy to acquire a particular location, such as Lae, New Guinea. At Lae, the sequential air strategy saw an interdependent series of operations executed in a specific order. Reconnaissance, air superiority, air interdiction, air transport and close air support were a standard sequence of operations at each Allied objective. Thus, the strategist discerns a series of sequential air strategies, each dependent upon the success of the previous strategy.

A cumulative air strategy of independent operations at the tactical level provided sufficient concentration of effort and ample effects to promote success at the operational level for each sequential step. Also, increasing attrition pressure promoted success for both sequential and cumulative air strategies at the operational and strategic levels. Not only did the sequential air strategies bring the Allies close enough to hit Japan directly, the attrition consequences resulting from the sum of sequential operations from New Guinea to Luzon had their own cumulative effect. Added with the effects of the strategic bombing and anti-shipping campaigns, cumulative effects attendant with the sequential operations allowed the Allies to create favorable conditions for victory.

In the SWPA, there is evidence that a cumulative air strategy facilitated the sequential air strategy and conversely, that a sequential air strategy facilitated the cumulative air strategy. These interactions contributed to the Allied victory over Japan in the Southwest Pacific Area.

Chapter 6

Sequential and Cumulative Air Strategies: The Interactions

There are actually two very different kinds of strategies that may be used in war. One is the sequential, the series of visible, discrete steps, each dependent on the one that preceded it. The other is the cumulative, the less perceptive minute accumulation of little items piling one on top of the other until at some unknown point the mass of accumulated actions may be large enough to be critical. They are not incompatible strategies. They are not mutually exclusive. Quite the opposite, in practice they are usually interdependent in their strategic result...The cumulative aspect has long been a characteristic of war at sea and may be a characteristic of air warfare. But there has been no conscious analytical differentiation of this cumulative warfare from the sequential in any of the major writings on strategy; and there is no major instance in which a cumulative strategy, operating by itself, has been successful.

—J.C. Wylie

This thesis has taken Admiral Wylie's challenge to examine both sequential and cumulative air strategies and attempted to answer the research question "How do the sequential and cumulative aspects of an air strategy interact to contribute to victory in war?" In considering this question, there have been six possible answers:

- 16 The sequential air strategy aids the cumulative air strategy.
- 17 The sequential air strategy hinders the cumulative air strategy.
- 18 The sequential air strategy has no interaction with the cumulative air strategy.
- 19 The cumulative air strategy aids the sequential air strategy.
- 20 The cumulative air strategy hinders the sequential air strategy.
- 21 The cumulative air strategy has no interaction with the sequential air strategy.

It is possible, of course, in any given operation or campaign for several of the above to be simultaneously valid. A re-examination of the interactions between the sequential and cumulative aspects of air strategy in each historical case should reveal patterns of such relationships and may lead to insights that will be of value to future strategists.

The Case Evidence

Battle of Britain

In the Battle of Britain, there were clear sequential aspects in the Luftwaffe's strategy to destroy Britain's Fighter Command. The five phases of the campaign, Kanalkampf, Operation Eagle, Airfields, Battle of London, and the Blitz were executed in sequence. In an interesting converse of Wylie's description of what constitutes a sequential strategy, the Luftwaffe based its sequencing not upon the success of the various phases, but rather upon their failure. That is, in failing to destroy Fighter Command in a particular phase, the Luftwaffe moved on to a new phase. There also was a strong cumulative logic underlying each phase and the campaign as a whole. Each phase contained independent air operations whose results accumulated to characterize the result of that phase. In turn, the effects of different phases accumulated to influence the campaign's success or failure.

Decisions the Germans made even before the campaign began reflect how the sequential aspect of air strategy hindered the cumulative. Aircraft design decisions and a failure to mobilize Germany's aircraft and pilot production capacities in 1939 and early 1940 left Germany without the optimal types or numbers of aircraft to conduct the Battle of Britain. Because the Germans did not have heavy, long-range bombers, it was difficult for them to produce sustained effects on vital targets in southeastern Britain. Also, the numbers of bombers, fighters, and aircrew available as a result of early economic mobilization and training program decisions left Germany without the strategic reserve necessary to prevail against the British. Thus, the sequential aspects of air strategy hindered execution of the cumulative strategy.

The Germans' record for understanding and executing the cumulative aspects of an air strategy was mixed; and where those insights counted most, they were the most unaware. Throughout the campaign, the Germans demonstrated they were conscious of the cumulative aspects of their air strategy as it affected the Luftwaffe at the operational level. Adjustments to flying tactics were intended to produce the operational effects of lowering their aircrew and aircraft losses. However, German leadership did not have a clear appreciation for the effects of the cumulative aspect of air strategy on the British or

what strategic-level measures were necessary for Germany to prevail. As a result, the Luftwaffe changed their sequential air strategy, curtailing operations in phases two and three that had the most potential for breaking Fighter Command. Also, the Germans did not increase fighter aircraft or pilot production during the campaign to support operations. The Luftwaffe's failure to appreciate the cumulative aspects of its air strategy in a broad context produced a dysfunctional relationship between the campaign's cumulative and sequential characteristics. The resulting lack of synergy contributed to Germany's eventual defeat.

Combined Bomber Offensive

In the Combined Bomber Offensive, the Combined Chiefs of Staff crafted a strategy that was both sequential and cumulative. The CBO's sequential aspects weakened Germany's ability to defeat an amphibious invasion by the western Allies. Thus, OVERLORD was logically dependent upon a certain level of success of the CBO. Within the CBO itself, the Allies correctly anticipated that gaining air superiority was a necessary pre-condition for sustained bombing. The cumulative aspect of the CBO was reflected in the years of independent air operations whose effects combined to neutralize the Luftwaffe as an effective fighting force, weaken the Wehrmacht's fighting potential against Allied ground troops, and ultimately destroy the economic base of the German war machine.

The sequential aspects of Allied air strategy thus aided the cumulative during the CBO. Economic decisions made by the Americans in their Victory Program and British efforts to maintain high levels of mobilization with shadow factories and purchases of American aircraft helped the Allies create resources deep enough to continue to supply aircraft for the CBO despite periodically high loss rates. Also, the Allies recognized that air superiority was necessary prior to fully implementing the cumulative aspect of their air strategy. They therefore described the destruction of the Luftwaffe as an "intermediate step" in the POINTBLANK Directive. The operational hiatus during the fall of 1943 while the Allies solved their long-range fighter escort difficulties also attested to their understanding that air superiority was a pre-requisite for destruction of the German economy. Fitting the P-51 with the Merlin engine provided the long-range

fighter necessary to extend air superiority into the German heartland, enabling continuation of the CBO. Finally, when Allied ground troops began converging on Germany from both the east and west, their progress resulted in destruction of German forward airfields and early warning radars, further enhancing the cumulative strategy.

The Allies also used the cumulative aspect of their air strategy to support the sequential. For example, the CBO's accumulating effects facilitated the success of OVERLORD, a necessary operation for the drive on the German interior. The CBO's cumulative effects from September 1944 through April 1945 were felt in other aspects of the Allied military strategy. The systemic attacks on Germany's oil production facilities and transportation network significantly undermined the Wehrmacht's ability to resist the Anglo-American and Soviet advances.

In sum, the CBO illustrated two of the possible interactions between sequential and cumulative air strategies. Each aided the other to contribute to Allied victory.

Southwest Pacific Area

The effects of air operations in the SWPA were, at the strategic level, almost mirror images of the CBO air strategies in Europe. Where in Europe the Allies used the cumulative to aid the sequential, in the SWPA the distances to reach Japan required using a sequential air strategy that would ultimately serve the cumulative. MacArthur's eventual capture of the Philippine Islands gave the Far East Air Force a base from which it was able to conduct systematic, sustained attacks against Japanese shipping. These attacks provided a vital enhancement to ongoing submarine operations and further crippled the Japanese economy.

Two layers of operational level sequential strategies also supported the cumulative strategy. First, General MacArthur, Admiral Ghormley, and Admiral Halsey moved from Port Moresby and Guadalcanal northward up the coast of New Guinea and the Solomons finally through the Admiralties, Moluccas, and into the Philippines. Second, at each landing a fairly standard set of sequential air operations took place including reconnaissance, air superiority, interdiction, transport and close air support.

The cumulative logic again underlay the success of the sequential aspect of air strategy. At each step in the sequential strategy, effects accumulating from independent

air operations combined to aid the success of the sequential strategy at that point. Japan's losses mounted with each Allied objective won. Allied losses also increased, but were offset by the ever-increasing numbers of aircraft and aircrew sent from the United States. Thus, each sequential step saw Japan's power erode and Allied power swell in cumulative fashion. The effects of the cumulative air strategy thus aided the sequential.

In sum, the SWPA illustrated two of the possible interactions between sequential and cumulative air strategies. Each aided the other in a synergistic fashion to contribute to securing an Allied victory in the Pacific.

A Cross-Case Analysis

It is clear from a comparison of the three historical cases that Wylie's suspicion about cumulative and sequential strategies is true in the case of air strategies: that in practice, the two strategies are usually interdependent in their strategic result. The research question under examination is: *how* do the sequential and cumulative aspects of an air strategy interact to contribute to victory in war? The CBO and SWPA air campaigns together illustrate that interactions between the sequential and cumulative aspects of air strategy include instances in which the sequential aids the cumulative and, conversely, instances in which the cumulative aids the sequential. Those interactions contributed to victory. When viewed from the German perspective, the Battle of Britain is perhaps an illustration that lacking an appreciation for the cumulative aspects of air strategy and failing to anticipate the cumulative aspects with appropriate decisions early in the sequential strategy, results in each aspect of strategy hindering its counterpart. The failure to achieve positive interaction between the two aspects of strategy contributed to the German defeat.

In summary, sequential and cumulative aspects of air strategies can either aid each other or hinder each other. When the interactions are positive, there is a high probability that these two components of an air strategy will contribute to victory. If the interactions are negative, however, defeat is more likely.

Implications

The paradigm of strategy being force applied across space and time provides a useful basis to examine the interactions between sequential and cumulative air strategies. In both shorter campaigns, such as the Battle of Britain, and longer air operations, such as the CBO and SWPA, planners must consider the obvious sequential aspects of air strategy. If there are intermediary steps necessary to win prior to moving forward with the strategy, those objectives (the space factor) must be clearly identified and pursued with the sufficient force and in the order (the time factor) dictated by the logic of the situation. In the case of air strategies, it appears that the intermediate step of gaining air superiority is a necessary phase prior to conducting other operations. In any campaign it is almost axiomatic that the ultimate effects of a strategy can not be instantly achieved. Therefore, strategists will almost always be reduced to devising a series of steps that lead to victory. When they do so, they should look for ways that these steps can both positively support and be supported by the cumulative aspects of the strategy. For example, some aircraft design choices as well as force structure decisions may more positively support the cumulative aspects of a campaign than other options.

In their pursuit, however, the less obvious cumulative aspects of air strategy frequently have important ramifications. First, the cases demonstrate that regardless of the duration of the campaigns (the time factor), the resource base and its erosion as a result of operations must be a consideration (the force factor). In a short campaign, either the immediately available resource base must be sufficient to resupply the force's attrition losses, or operations must be significantly more efficient than those of the adversary. During the Battle of Britain, the Germans did not have sufficient resources to prevail over the British, nor could they produce such resources in the course of a short campaign. This problem was compounded by the fact that the Luftwaffe did not have a favorable attrition rate vis-à-vis the RAF. In fact, it was the opposite case since Luftwaffe loss rates outstripped Fighter Command's statistics. In a longer campaign, while the immediate efficiency of operations might not be a factor in countering attrition costs of the campaign, strategic-level decisions must be made in sufficient time to reinforce equipment and manpower for the campaign's long-term attrition demands. In the case of the CBO and SWPA operations, the Allies realized they had time to build up

resource strengths and that the cumulative effects gained in the interim would eventually weigh more upon the Germans and Japanese than they would upon the Allies. Ultimately, a successful cumulative air strategy demands that the force necessary to secure the objective is available at the correct place and time, and that the adversary is denied the same.

A second aspect of the space/force/time conceptual framework of interest in the cumulative air strategy is the ability to identify the correct targets (the space factor), measure the effects of the pressure (the force factor) applied upon those targets, individually and cumulatively, during the course of the campaign (the time factor). All three historical examples illustrate the difficulty in identifying the targets, measuring the effects accurately, recognizing unanticipated second order effects, and predicting when effects will be decisive. The cumulative air strategy balances a tension between two philosophies. The first philosophy is that the cumulative strategy should concentrate upon what Air Marshal Harris called panacea targets, or a limited number of targets that are anticipated to have great effect with their destruction. The alternative view is that the value of the cumulative campaign is in a measured dispersion of effects across a number of targets whose destruction in combination will provide, in Wylie's words, "the minute accumulation of little items piling one on top of the other until at some unknown point the mass of accumulated actions may be large enough to be critical." The lessons of the cumulative air strategies executed during the Battle of Britain, the CBO, and the SWPA show that the "art of the cumulative" is in choosing the most appropriate targets, applying the correct amount of concentrated or diffused pressure across those targets, accurately measuring those effects, and convincing the leadership that some combination of those effects will eventually result in the enemy's capitulation. In the final analysis, only the adversary will determine which effects will compel his submission . . . and when that will be.

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